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R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

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The Daredevil!

Better Crops with PLANT FOOD

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VOL. XXXIV WASHINGTON, D. C., APRIL 1950 No. 4

We can learn from . . .

Buoyant Belgium

Jeff McDermid

MARTIAL music in the cobbled, winding streets and the dull boom of explosives in the orchard bordering the fields of Flanders on one bright September day of 1949 did not cause the despair and alarm so common around Ellezelles, Belgium, during two world wars.

This time no tanks and mopping-up squads rumbled into the little village, but a glance at the "officieel programma" within the covers of a yellow catalog told us that the national exposition of agriculture and horticulture was to be opened that morning with pomp and pleasantry by his honor, the Herr Minister of Landbouw, and the local gentry led proudly by Jean Vinois, Burgemeester of Ellezelles, aided by his gracious excellency, the Gouveneur of the Province of Henegouwen.

It all looked faintly familiar, a distant echo of many county fair gala days back home in the States—especially the robust and zealous farm implement demonstrators for manufacturers and dealers. Their array of bright steel and painted iron devices was assembled in the town square—a gently sloping stone-paved yard between the ancient square-towered church and the stores and refreshment cafes at the lower edge where the main street crossed the exhibit areas.

Here the "machines agricoles," the "tracteurs," motorculturen, the potato diggers, the wine casks and presses, the combines, the grain seeders, the insect sprayers and dusters, the cream separators, the porta-

ble electric milking machines, the grass mowers, and the less pretentious hand tools were being inspected after the fashion of discriminating farmers in every land where their craft is paramount. And it's paramount in Belgium, to be sure, because of the teeming urban population whose birth rate is gaining on the capacity of agriculture—even at its modernized best. Each 200 persons of Belgium's total population of over eight million people has about 100 acres of farm land to rely upon for food. Because folks and more folks are so plentiful and land is so scarce and valuable, the general desire is to attain a high crop and livestock output per acre, regardless of how relatively low such a total volume may be when figured on the basis of farm employment. That is, yield per worker is not nearly as practical a goal to them as yield per acre—which by the way, is often surprisingly high even measured on the American terms.

HOWEVER, at this fair in Flanders the children were running everywhere peering and pointing, and their mammas stood on the clean stoops beside the heavy old doorways in the brick and stone houses, watching the goings and the doings on this best and most zestful of Ellezelles times. Farmers and their families in holiday dress trudged up the middle of the streets, many of them having arrived on foot and others coming by team and motor cars, to witness all these wonders, to gossip and trade, and learn how to keep up with the fast European recovery pace—if weather and good fortune and silent prayers could make it come true.

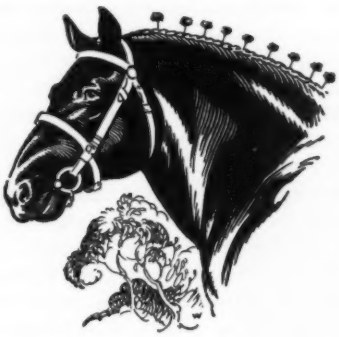
Many authorities said that few of these curious farmers knew very much about the United States financial aid program or what counterpart funds were and what they are doing in furnishing equipment in more than normal supply. But others retorted convincingly that neither did these peasant citizens know much about the sun or the rain or the science of the soil—or even of the facts of theology—but these missing details never stopped them from sowing and weeding and reaping or kept them from attendance at church or wayside shrine. It's what they perform and produce that counts, and the cause will be credited when the effect is realized.

OUR American farm tourists stepped stiffly down from the two big Brussels buses to join the country crowd. They grinned and shook hands and otherwise tried to make it clear in facial rather than Flemish language how tickled they were to be on hand for this farm exposition. They wanted the Belgians to know that they were also landsmen, and hence well equipped at all times with the password of the "corn plant at the waterford" and could advance the horny palm grip of furrow fellowship. In short, the Americans gave notice that they were truly worthy of being accepted into the inner crafts of any exposition "agricole, horticole et pomologique."

Yes, and a few of these Yankee farmers were able to grasp a native hand and say, "I remember this country of yours in the smoke of 30 long years ago —all the way from here to Ypres. Thanks all the same for tending those graves of my buddies out there on Flanders fields where poppies grow." So in a way it seemed to be a double reunion—that of the passing generation for the losses and the blunders past repair, and for the hopeful ones who look again to a future when guns will cease and rural meadows be free of marching men. It may sound ivory towerish, but they have high hopes that agricultural understanding and unity may finally cement broken ties and misunderstandings all over the world. Most of us merely smile at this wishfulness and mutter "So mote it be!"

Thus in everyday fashion devoid

of dreams and visions, we pushed our way through the Belgian throngs, trying to be realistic and not fatalistic, trying to make ourselves believe that seeing is proving and that there is just as great potential power in the small farmers of raddled old Europe as there was in America after the dilemmas of the depression had been faced and overcome. One point we could tell for sure—these rural men and women enjoyed the fair in all its phases taking keenest delight in learning the newer and the better ways.



We lacked the time to enroll in any of the conferences "educative," but we all elbowed our way into the several grand divisions into which the fair was divided. There were the Section de l'Agriculture, Section de l'Horticulture, Section de l'Arboriculture Fruitiere, Section de la Floriculture, Section Materiel Agricole, Section Pepinieres, (or ornamentals, shrubs, and espaliers). Electricity on the farm, a hall of cereals and potatoes, and kindred main crop systems featured the agricultural section. Tree and vine fruits and medicinal plants were seen in profusion in the horticulture rooms. Most of our visiting group were buying great, luscious bunches of grapes and nibbling at huge, solid, tempting pears, as they meandered through the crowds and tried to find out what kind of special skill and training it required to produce the quality of vegetables and fruits which the show displayed. I doubt if they ever did find out the answer, yet they all recalled a previous day we had spent in the section south of Brussels in the region of famed Waterloo, noted for the greatest concentration of grape houses in the world.

This hot-house grape business was a real surprise for even such technical vine experts as our New York and California delegates. Commercial grape culture under glass in Belgium began in our Civil War times. Holland has a small area with similar equipment. Since 1900 the industry has centered at Overijsche and Hoeilaart, and if all the 33,000 "greenhouses" were put in one cluster they would cover 1,250 acres. Growers told us that Belgium's average yearly output exceeds 25 million pounds. You never saw such grapes. On second thought, maybe you have seen them, for sale on some super-markets and served at fancy restaurants that import these black and white globes. The black varieties brought to juicy perfection under coal and sun heat combined are the Royal, Colmar, Hambro, and Leopold III, while two white varieties predominate—the Muscat and the Canon Hall.

MOST of the grapes under this hot-house system are raised by small farmers as a family enterprise, each owner having 10 to 20 glass enclosures. Here and there are "muscat magnates" who run perhaps as many as two or three hundred greenhouses. Each house has a narrow central aisle, where, as you walk, the thick vine arbor arches and bends above your head. The roots of the vine are located well back toward the outer glass walls and the branches twine upward and forward, heavy with grapes of all shades from the unripe green to the pulpy purplish black and clear white of the mature fruit. Visitors are cautioned not to rub or touch the vines and clusters, so all a hopeful devotee can do is to keep his mouth open and hope that a windfall may drop into it. Of course,

(*Turn to page* 47)

Birdsfoot Trefoil— A Promising Forage Plant[1]

By A. R. Midgley

Chairman, Agronomy Department, University of Vermont, Burlington, Vermont

BIRDSFOOT trefoil is an old legume with new life. It was recognized in Europe over 300 years ago and was actually introduced and tried out by some agricultural experiment stations in this country over 50 years ago. However, it was given only a limited amount of attention until about 1934 when it was found in several New York counties during a pasture survey in that state. Farmers recognized it as a good pasture plant and as having been present in these areas for at least 20 to 25 years.

There are many current theories regarding its initial introduction. The most logical one is its spread from ballast dumps along the Atlantic Coast and Hudson River. Its spread through forage and hay loft sweepings and other material, accompanying the importation of livestock from Europe, is equally logical. The plant is common in the vicinity of railroad yards, such as in Albany, N. Y., and a very old pasture stand of the narrow leaf variety was recently found along Lake Champlain in Shoreham, Vt., in the vicinity of "Panton Meadows," a prominent settlement in the days of Ethan Allen. It seems that birdsfoot trefoil also was introduced at an early period near Portland, Oregon, which is an important seaport.

Birdsfoot trefoil is a long-lived legume. There are two important but different types: (1) Narrow leaf (variety tenuifolius) which has narrow, slender leaves, weak stems, and a rather fibrous root system; (2) Broadleaf (Lotus corniculatus, variety vulgaris) which has broader leaves, more erect stems, and a more pronounced taproot. The narrow leaf variety has 6 chromosomes; the broadleaf 12. Therefore they do not cross or mix. In addition to the above, there is a European broad leaf type which has even larger leaves than the ordinary broadleaf. It has large leaves, is more erect, starts quicker from seed, and recovers sooner after cutting than the American strain. Selections of this plant are being made, but at present it is extremely variable, and frequently is not as winterhardy and does not stand close grazing as well as the New York broadleaf called Empire. Most of the present European stocks come from Italy.

At first glance the leaves of broadleaf trefoil appear to be similar to alfalfa, but they are lighter in color. They are grouped in three's (meaning trefoil), but they also have two smaller leaflets at the base of the leaf branch, actually making five in all. These extra leaflets, or wings, are an important distinguishing characteristic when the plant is young.

The flowers are in groups of two to eight, each like a tiny orange-yellow sweet pea about one-half inch long. The seed pods, of course, are the most outstanding character and give the name birdsfoot. They are about 1½ inches long and radiate out from the stalk like toes of a bird's foot. Each pod contains about 10 seeds. When ripe and dry it snaps open and scatters

[1] Printed by permission of the Vermont Agricultural Experiment Station; Journal series, paper No. 13.

the seed a distance of several feet. This makes seed growing very hazardous. The seeds of this plant are somewhat smaller than red clover and alfalfa and range in color from olive green to dark brown.

The root system of birdsfoot trefoil is intermediate between alfalfa and red clover. It is more shallow than alfalfa but deeper than red clover and more branched. The broadleaf variety with its long taproot frequently goes down four to six feet, which makes it rather drought resistant. The narrow leaf has a more fibrous root system which seems to make it better suited to poorly drained heavy clay soils than the broadleaf. The narrow leaf variety does not "heave out" of clay soils very readily during the winter.

This is truly a triple purpose forage plant—pasture, silage and hay. As a pasture plant it is slower in starting growth in the spring than ladino or white clover, but it frequently produces better midsummer feed when they are dormant due to hot dry weather. Of course on good ladino-clover land, ladino produces much more feed than trefoil, but usually does not live as long. Birdsfoot trefoil can withstand overgrazing as well as close fall grazing better than most other legumes. This is important when fall feed is scarce and meadows are grazed. There has never been a case of "bloat" with grazing animals, which is always a risk when alfalfa, ladino, red, alsike, or sweet clover is grazed.

For silage, birdsfoot can hardly be beat. It is very palatable and good-smelling because it produces a minimum amount of odor. For a hay crop, trefoil is superior to ladino clover. It is more erect and easier to harvest and cure for hay. It can also be cut very late in the summer, if necessary, and still make better hay than alfalfa or the clovers. The reason for this is that birdsfoot trefoil continues to grow and send out new leaves from the terminal branches. Furthermore, the stem is fine and palatable regardless of age. Even though birdsfoot trefoil is not cut until late August or early September, it will still be in a vegetative state, having new green leaves, flowers, and seed pods on the same plant.

The feeding value of birdsfoot trefoil hay is comparable to other good leg-

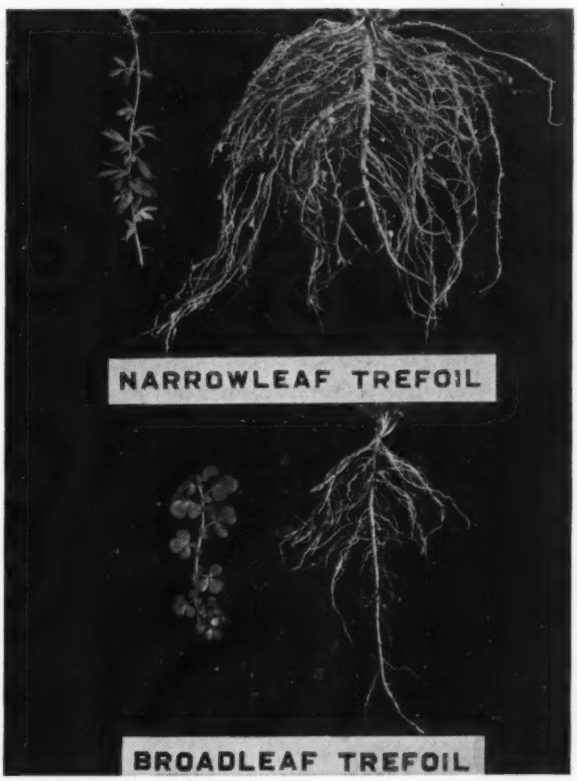


Fig. 1. Narrowleaf trefoil has small narrow leaves and a more extensive and fibrous root system than the broadleaf variety. It will grow on wetter soils, but for most purposes, particularly hay, it is inferior to broadleaf. Size and shape of leaves are the main distinguishing characteristics.

TABLE I.—YIELD AND PROTEIN CONTENT PER ACRE OF TREFOIL WHEN CUT AS PASTURE, EARLY HAY, AND VERY LATE HAY ON A HEAVY CLAY SOIL.

Cutting treatment	1947 lbs.	1948 lbs.	1949 lbs.	Average lbs.	Protein	
					%	lbs.
Pasture	3,636	3,611	1,477	2,908	18.95	551
Early hay	3,277	6,312	4,236	4,608	15.07	694
Very late hay	4,802	5,802	2,249	4,284	11.30	484

ume hay. The proportion of leaves to stems is similar to alfalfa, but both stems and leaves are finer. Full bloom is the best time to cut, and it frequently produces from two to three tons per acre. It must be handled carefully to preserve the leaves because they break off more readily than alfalfa or red clover. The second cutting is usually small but it does produce good aftermath for grazing.

The yield and protein content of birdsfoot trefoil when cut frequently to simulate grazing and when cut in the early as well as the very late stage are shown in Table I.

Highest yields and total protein were produced when cut at early hay stage. Over 2¼ tons of hay and 694 pounds of protein were produced per acre. In spite of the fact the very late hay stage was cut about September 8, over two tons of good hay and 484 pounds of protein were produced. There are very few if any other hay plants that can be cut so late and still produce such good quality, high protein feed.

The relative value of birdsfoot trefoil and timothy, compared to ladino clover and timothy, on a clay loam that was quite well suited to both plants is shown in Table II.

These seedings were made in 1942. During the first three years, ladino clover produced more feed than the trefoil, but from then on the latter was much better and averaged 1,000 pounds more hay per acre, per year, during the seven-year period. Much of the ladino clover died out after the third year, but by natural reseeding a relatively good stand was reestablished. The stand of birdsfoot, on the other hand, tended to improve each year, although in 1949, yields of both plants were poor because of dry conditions. In general, birdsfoot trefoil is adapted only to long rotations because it is slow in becoming established.

Soil Adaptation

Birdsfoot trefoil is frequently called a poor-land crop. Of course, it will "exist" on land that is acid and low in minerals, but yields are low under these conditions. Its ability to grow under poor soil conditions is the main reason it was discovered. In New York it was

TABLE II.—COMPARISON OF LADINO CLOVER WITH TIMOTHY VS. TREFOIL WITH TIMOTHY, GROWN IN FIELD PLOTS ADJACENT TO EACH OTHER.

Seeding	Pounds of early-cut hay per acre							
	1943	1944	1945	1946	1947	1948	1949	Av.
Ladino & timothy	3,670	2,240	4,558	4,759	6,560	6,013	2,590	4,341
Trefoil & timothy	3,130	2,000	7,392	7,777	7,069	7,434	3,593	5,485

found on poor, wet, stony land where little plowing was done and where there was little competition with other plants.

Birdsfoot trefoil is adapted to an extremely wide range of soil conditions. It has been found growing well on gravel ridges that are much too droughty for ladino clover, and it does much better than alfalfa on heavy clay soils that are wet. In fact, it will grow on wetter soils than practically any other legume. In Vermont some 75 plantings were made throughout the State in 1941. In practically all cases the best stands were obtained on the clay soils. It seems that the reason it does not grow better on sandy soils is lack of fertility. Clay soils are usually high in potash and lime.

Birdsfoot trefoil, like most other legumes, grows best on soils well supplied with lime. The optimum pH in the plow layer is about 6.5. On the clay soils in the Champlain Valley good stands have been obtained where the soil is more acid than this, but growth is usually slow until the deep roots reach the high lime subsoil, which is frequently at a depth of 18 inches. Soils that are not favored with this lime-bearing subsoil require higher lime additions. Birdsfoot trefoil, like alfalfa, feeds deeply in the subsoil and prefers good fertility in that area. Most sandy soils are at a disadvantage in this respect.

The old saying, "It takes money to make money," applies here because it takes good fertility to produce good forage feed. It is false economy to starve any plant even though it will grow with low fertility. In general, birdsfoot trefoil should be fertilized the same as for red clover. However, there is a marked exception. Manure should not be used the first year because of extra weed seed introduced and the tendency for excessive growth and competition from the faster growing plants. Nitrogen is not recommended because of the same tendency to produce excessive competition.

A number of fertility tests with birdsfoot trefoil have been conducted on both heavy clays and sandy soils. The results on a heavy soil (Panton Clay) are shown in Table III.

These results show that the greatest responses were obtained from use of superphosphate, but even on this soil with its rather high potash content, an

Fig. 2. On wet land, birdsfoot trefoil and reed canary grass have grown well together. If the grass becomes too vigorous, it should be pastured or cut for silage to reduce excessive grass competition.

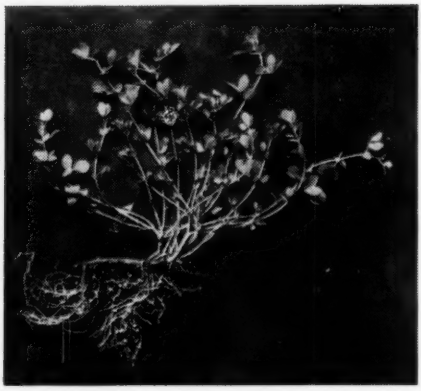


Fig. 3. Birdsfoot trefoil is one of the few legumes that will produce a new plant from a section of root. Breaking of roots by "heaving" or disking may actually help to thicken the stand, but it cannot be relied upon to do this.

annual application of 60 pounds of P_2O_5 and 15 pounds of K_2O produced nearly 1½ tons of extra hay per acre. The addition of nitrogen to the minerals actually caused a decrease in yield, primarily because of excessive grass growth. Data are not presented here but on a lighter soil, which was naturally more deficient in potash, even greater responses were obtained with this element. Borax also has been beneficial especially where large amounts of lime have been used. About 50 pounds of borax per acre in conjunction with manure after the second year of seeding have been very beneficial.

Since birdsfoot trefoil is a legume, it depends upon suitable organisms for nodule production and nitrogen-gathering properties. When properly inoculated, bacterial nodules are produced on the roots near the crown when the plants are very young. Later on most of the branching roots at greater depths develop clusters of these beneficial bacteria. Most soils do not contain this special type of organism, therefore it must be added to the seed at time of planting. Frequently seed dealers supply a can of inoculin with the seed, if not, it must be purchased separately. The inoculating material used for alfalfa, clover, beans etc. is not satisfactory because trefoil requires a special type.

Proper inoculation for this plant is so important that extra attention is worth while. Most inoculation material comes as a black, moist powder. Trefoil seed are so smooth that frequently the powder and organisms do not stick to the seed well enough to give good results. One very good method to overcome this is to add a handful of powdered clay, or other similar material, to the water before it is used to moisten the seed and inoculin. In this way all seed become coated with a thin layer of clay which sticks and holds the organisms to the seed.

Another and even better way is to add the powdered inoculin to pulverized sheep or old decayed dairy manure which has been dried and screened.

TABLE III.—FERTILIZER TRIAL ON BIRDSFOOT TREFOIL GROWN ON A HEAVY CLAY SOIL.

Fertilizer, lbs., per acre, per year N–P_2O_5–K_2O	Pounds of hay per acre			
	1947	1948	1949	Average
Check*	2,776	5,528	3,191	3,832
0–45– 0	3,986	6,364	4,545	4,965
0–45–15	4,941	6,790	4,628	5,453
0–60–15	5,822	8,871	5,299	6,664
15–45–15	4,542	6,812	3,811	5,055

* All plots, including check, received a basic treatment of lime and 300 pounds of superphosphate (60# P_2O_5) per acre when planted in 1946.

The manure-inoculin mixture should then be moistened for a better mixture of the two materials. This method has proven to be so successful it is thought that the manure acts as a "home" for the organisms and supplies food and protects them against excessive drying and sunshine after seeding. Some experimental evidence showed that the number of these desirable organisms increased greatly in this organic medium. Dried sheep manure or other material pulverized to the same size drills very well with the trefoil seed and therefore acts as an excellent material to dilute the seed for better planting. Equal volumes of seed and pulverized manure are recommended.

Seeding Methods

A good firm seedbed is important for trefoil. The seed are small and must not be covered deeply. They usually do best when covered with only ¼ to ½ inch of soil. A corrugated roller or cultipacker with small seed attachment is quite ideal. Grain drills are satisfactory but the small seed spouts should extend behind the regular grain and fertilizer spouts or disks, so that the seed will not be covered too deeply. A small amount of mineral fertilizer, especially superphosphate, can be drilled directly with the seed by running them through the same spout without burning or injury to the seed. Care must be used to see that the disks or shoes make only a very shallow furrow. The seed are then covered with chains following the drill or subsequent use of a cultipacker or roller.

We have obtained best results with trefoil when seeded as early as possible in the spring. This is advisable because trefoil starts slowly and it should be given a good start to survive the winter and frequent summer droughts. For the same reason, a so-called "nurse" or companion crop of oats should be used sparingly if at all. Either brome grass or timothy makes a good grass association. This type of grass is quite necessary to hold the trefoil plant up for easier cutting in hay production. Usually six to eight pounds of grass seed to five pounds of trefoil per acre are necessary for good stands. Clover or alfalfa should not be added to the above mixture because of their rapid growth during the first year or two.

Management

Trefoil must be managed (cut or grazed) properly the first year to reduce excessive competition by weeds, clovers, and other plants. Because it grows slowly the first year, competition by fast growing plants frequently crowds or smothers it out. Annual weeds and even red clover must be controlled by frequent clipping or occasional grazing and clipping. Grazing or the mower should be used the first year whenever the vegetation exceeds six to eight inches in height. If cut at this time it can be mowed rather closely because trefoil sends out new stems near the base of the plant. Close, early cutting when all vegetation is young actually damages most weeds more than it does the trefoil. Occasional grazing, or rather frequent clipping, is one of the most important factors in successful establishment of trefoil. Of course, this lessens the income of the land for one year, but with this long-lived legume, this loss is justifiable.

Seed Production

Birdsfoot trefoil usually produces a good crop of seed. The Vermont Station has produced from 300 to 400 pounds per acre. Harvesting, however, is very tricky and difficult. Frequently all the seed are lost, and 50 to 100 pounds of harvested seed per acre is considered a good yield. The plant blooms and sets new seed pods over a period of several weeks. Thus there are mature and green pods as well as flowers on the same plant. One must guess when most seed are ready because the mature pods split and expel the seed as soon as dry. Because of this diffi-

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Potash Production—
A Progress Report

By J. W. Turrentine

Washington, D. C.

THE accompanying chart, "Potash Deliveries, Agricultural and Chemical, North America," tells the story of the production increase by the American potash industry from 283,000 tons K_2O in 1938, the last normal prewar year, to 1,110,00 tons K_2O in the calendar year 1949. Of this total 1,039,000 tons K_2O were for agricultural, and 67,000 tons for chemical use. Of the 1,039,000 agricultural K_2O, some 955,000 tons were consigned to 45 states and the D. C., 42,000 tons to Canada, 5,000 to Cuba, 14,000 to Puerto Rico, and 12,000 to Hawaii. In addition, some 11,000 tons K_2O were exported to several other countries, principally of Central and South America. Imports into the United States and Canada shown on the chart amounted to 40,000 tons K_2O. In 1938, North American imports amounted to 225,000 tons K_2O.

The data on which this chart is based are briefly summarized in the following tabulation.

TABLE I.—POTASH (K_2O) DELIVERIES, AGRICULTURE AND CHEMICAL, NORTH AMERICA (UNITED STATES, PUERTO RICO, HAWAII, CANADA, & CUBA)

	1938 Tons	1943 Tons	1949 Tons
Domestic....	283,000	730,000	1,110,000
Agricultural..	268,000	646,000	1,039,000
Chemical....	15,000	84,000	67,000
Imports.....	225,000	000	40,000

While use is made of the term *production,* it should be explained that the data being used here relate to *deliveries,* not necessarily synonymous but approximately so, since orderly shipments from refineries are now largely successfully organized. These delivery data are reported under confidential cover to the American Potash Institute by producers and importers to be totaled and released quarterly to the interested public. On this basis total deliveries in 1949 amounted to 1,146,000 tons K_2O, a decrease of 2.4% below that of 1948 due to a strike in the Carlsbad Potash Industries, thus interrupting for the first time an unbroken record of ever-increasing American production.

These reports of deliveries are received from the five major potash producers which are, alphabetically listed:

The American Potash and Chemical Corporation whose refinery is located at Trona in the Mohave Desert of California and whose raw material is the highly complex brine of Searles Lake.

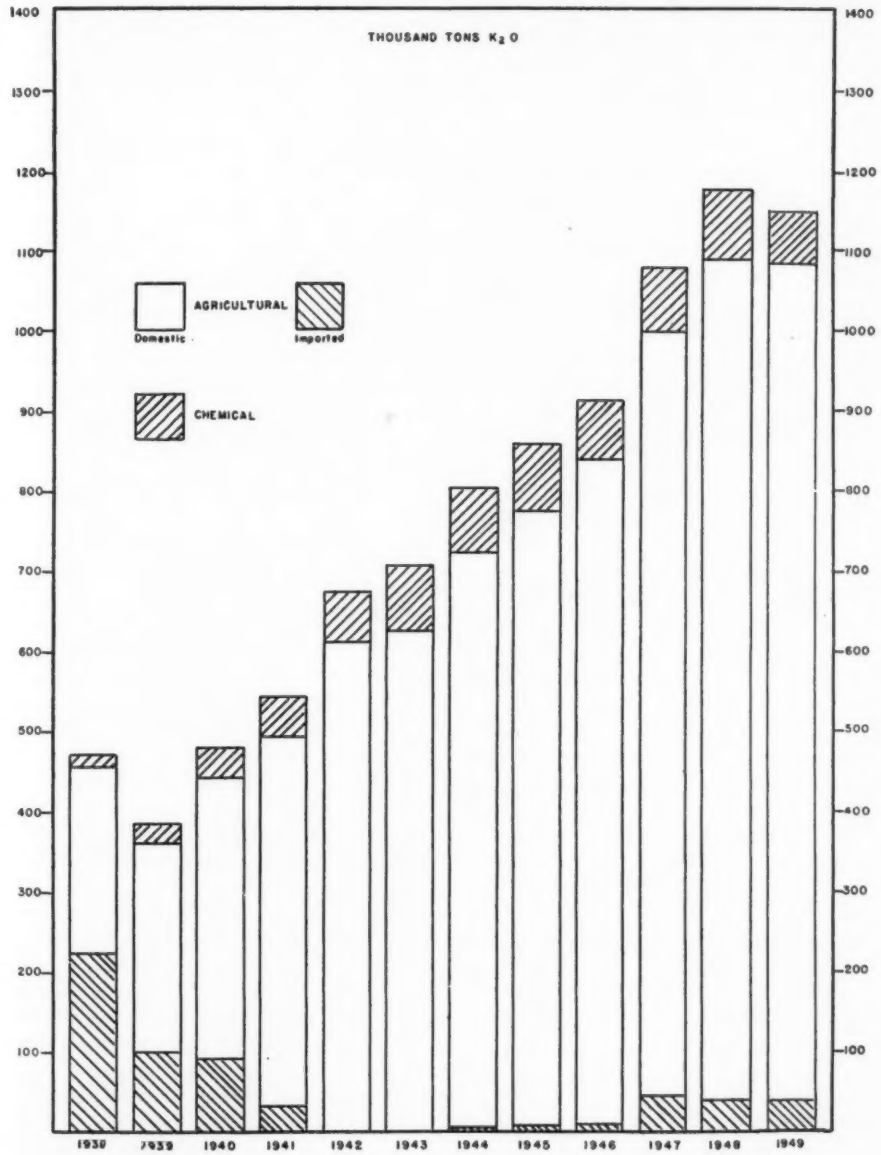
Bonneville Limited situated on the salt flats of western Utah, whose raw material is the brine impregnating the muds underlying that salt crust.

International Minerals and Chemical Corporation, Potash Company of America, and the United States Potash Company whose mines and refineries are located in the Carlsbad area of southeast New Mexico and whose raw materials are the subterranean deposits of potash salts underlying that area.

Smaller tonnages of potash salts are produced by the Dow Chemical Company as a by-product from their processing of the natural brines of Michigan.

POTASH DELIVERIES – AGRICULTURAL & CHEMICAL

NORTH AMERICA



The total 1949 delivery of 1,146,000 tons K_2O was contained in 2,105,000 tons of potash salts, made up of the 60 and 50 per cent muriates of different crystal sizes, and the run-of-mine or "manure salts" as known in the fertilizer trade, the sulfate and the double sulfate of potash-magnesia. Of this tonnage the highly refined 98 per cent potassium chloride (60% muriate)

amounted to 936,520 tons K_2O, representing 81 per cent of the total.

High-grade Muriate

The question might be asked, Why carry the refining process to the extreme of 98 per cent purity only to have the product diluted back to the 5 or 10 per cent K_2O fertilizer grades for retailing to the farmer and further diluted by him when he mixes 100 pounds, let us say, with 2 million pounds of soil constituting the top six inches of an acre of ground? The answer is *freight*—and the degree to which potash salts are being refined, increasingly so on the basis of the total output to further decrease freight charges, represents an outstanding achievement of the potash industry on which progress is still being made.

For example, concurrently with an increase of 400 per cent in production since 1938 there has taken place a 325 per cent increase in the production of the 98 per cent KCl grade, and with the added refining capacities now in full production or under construction this proportion will be progressively increased.

The relationship between concentration and freight per unit is a matter of importance to the man who pays the freight. With an average primary freight charge of $13 per ton of potash salts from the New Mexico refineries to widely scattered fertilizer mixing plants. the charge per unit K_2O in the case of the 60 per cent K_2O grade is $.22 as compared to $.26 for the 50 per cent grades and to $.52 for the 25 per cent grades. Here is a reduction in cost to the consumer of $.30 per unit K_2O resulting from the elaborate refining operations of the potash producers. Applied to the 937,000 tons of K_2O so refined, the saving in freight charges amounted to $28 million in 1949.

As stated, the expansions in refining capacities in operation during 1949 are designed to further increase this overall saving. Thus we may expect a decrease in deliveries of low-grade "manure salts" below the total of 46,100 tons K_2O (4 per cent of the agricultural salts) delivered in 1949 unless further increases in agricultural demands impel their shipment in the unrefined state as has been the case in recent years, their marketing at the behest of the buyers being prompted solely by potash demands beyond previously existing refining capacities.

New Developments

Progress is being continued in respect to both increased production capacity and average concentration of the marketed product, a statement applicable in varying degree to all the major producers. Still adhering to the alphabetical order, the five major producers will be considered briefly in the following paragraphs:

The American Potash and Chemical Corporation of Trona, California, has registered progress in various directions in increasing production with added efficiencies. From its raw material, the highly complex brine of Searles Lake, a long list of chemicals, it is recalled, are being produced. These include high-grade muriate of both agricultural and chemical grades and of different crystal sizes, potassium sulphate, borax (hydrated and dehydrated), boric acid, salt cake, soda ash, bromine and bromides and lithium concentrates. To maintain such a list of major and side products in balance with increasing potash output and market demands represents problems that call for frequent technological improvements in plant operations. Enlarged research and pilot plant laboratories have been built and equipped to provide for the ever-expanding research program.

Bonneville Limited, near Wendover, Utah, situated in the vast salt flats of the western part of that State has improved its refining facilities during the past year whereby the output of muriate of potash has been increased. This unique enterprise in the past has relied upon an extensive system of ditches as its source of dilute brine which is

pumped therefrom into a series of large solar evaporation ponds. To augment the supply of brine, several deep wells have been bored. In addition an electrical power plant has been installed and sources of fresh water from deep wells have been developed.

Since the Carlsbad, New Mexico, producing center provides most of the potash currently supplied, what transpires in that area naturally may be of major interest to the fertilizer chemist.

The International Minerals and Chemical Corporation, producers of potassium chloride from the mineral sylvinite and of potassium sulphate and the double sulphate of potash-magnesia from the mineral langbeinite, has expanded its muriate production and has revamped its sulphate production facilities to improve the percentage recovery and the quality of its agricultural sulphate. In addition it has installed facilities for the production of the specially refined potassium chloride designed for the chemical industries. At the same time it has revamped some of its mining operations to improve both efficiency and output.

The Potash Company of America, whose principal product has been the high-grade muriate with some potassium sulphate produced through collaborative arrangements by salt cake manufacturers, has brought to completion its $4 million expansion program to increase its muriate capacity by 25 per cent including a 50 per cent increase in capacity for its chemical grade of potassium chloride. This comprehensive expansion program has involved both mining and refining facilities—an increase in hoisting capacity of some 65 per cent and added flotation units with collateral equipment, such as thickeners, filters, conveyors, and dryers.

The United States Potash Company is enlarging its refinery capacity with improved efficiency to provide a substantial increase in its output of high-grade muriate. Included is the installation of a nine-section forced draft Morley cooling tower for cooling the water used on its crystallization equipment as likewise that to be passed through steam turbine condensers. This is of particular benefit during hot summer months, preventing the let-down in production due to inadequate cooling during that period and thus providing a more uniform year-round production level. This increased refining capacity means the diversion of run-of-mine salts formerly marketed as such to the refinery for conversion into high-grade muriate.

All three companies in the Carlsbad area have continued research in every branch of their operations, from mining to refining. This has resulted in improved practices including drilling, blasting, haulage of the raw salts both below and above ground, mining machinery, hoisting, flotation, leaching, thickening, crystallization, filtering, and drying. Situated in a desert area, water supply is of major concern, a problem solved by piping in water from remote sources. Ever-increasing economies are essential if current low prices are to be maintained with wages at the highest levels paid in any comparable industry.

Speaking of prices and progress—progress may be claimed as continuing in the ability of the potash producers still to sell at prices virtually at the prewar levels against an ever-mounting rise in the cost of labor, materials, and services in general. Certainly this applies to high-grade muriate, 81 per cent of the total of domestic potash production, the only one of the three major plant foods that has not increased in price. Thus potash prices within the United States are lower than those prevailing in international commerce—connoting progress still being maintained in resisting the enticements of the export market in consideration of the requirements of the American farmer.

Exploration

The Carlsbad area continues to attract the interest of prospective new

potash producers. Conspicuous among these is the Duval Texas Sulphur Company of Houston, Texas, which at the end of the year announced in the press its plans for entering the potash mining and refining industry under the name of the Duval Sulphur and Potash Company, following two years of intensive exploratory work on Federal and State lands in the Carlsbad area of New Mexico. Resulting from some 60 core tests at a stated expenditure of $450,000, potash ore bodies were located. These were of sufficient dimensions and richness to warrant the drawing up of plans, as announced, for the development of a mine and the construction of a refinery at an estimated cost of $7,500,000 to be expended over the period of the next two years.

The acreages covered by the Federal permits to this new entrant into the potash-producing field are close to those held by the other three producers in this area. It is estimated that one of these permits granted the Duval Company overlies a minimum of 14,000,000 short tons of potash ore currently available by present mining practices, which means without pillar robbing.

Thus, in due season, there is the prospect of four mines and refineries operating in the Carlsbad potash producing center. In addition, 22 leases and 177 permits have been issued by the Land Office of the U. S. Department of the Interior for further prospecting for potash on public lands in New Mexico, California, Utah, and Colorado.

Changes in Distribution

Returning to distribution, definite progress has been registered in recent years with respect thereto, both geographically and agronomically. To the fertilizer chemist familiar with the fertilizer distribution pattern of past years, it is well known that the consumption of plant food in mixtures was more widespread in the Southern States. While these mixtures were low grade by present standards, carrying but a few units of potash, the aggregate mixed goods tonnage sold in that area was of sufficient dimensions still to effect the retail distribution of the major part of the potash used in American agriculture. To illustrate, in the State of North Carolina, the leader in the tonnage consumption of mixed goods with considerably over one million tons per annum, 15 years ago some 45 per cent of the tonnage was in the form of the 3-8-3 mixture. In 1948, by contrast, 71 per cent of the total contained 6 units, and 15 per cent contained in excess of 6 units K_2O. In point of potash consumption the South still leads, but that progress is being made toward a more uniform geographical distribution is illustrated by the following figures:

Comparing delivery figures of the calendar years of 1940 and 1948 we find that in the 10 Southern States including Virginia and Tennessee on the north and Texas on the southwest, 152,000 tons K_2O or 50 per cent of the U. S. total were delivered in the earlier year as compared to 446,000 tons K_2O or 46.5 per cent of the total in the latter year.

In the seven Midwestern States including Ohio on the east to Iowa on the west, 1940 deliveries of 64,000 tons K_2O were 21 per cent of the total compared to 285,000 tons K_2O which were some 30 per cent of the total of U. S. deliveries in 1948. While in the 10 Southern States there was a 293 per cent increase in deliveries during this nine-year period, in the seven Midwestern States there was a 445 per cent increase. These data are summarized in Table II.

TABLE II.—CHANGES IN POTASH (K_2O) DELIVERIES BY SECTIONS.

Ten Southern States	*Seven Midwestern States*
1940—152,000 tons	64,000 tons
U. S. Total, 50%	21%
1948—446,000 tons	285,000 tons
U. S. Total 46.5%	30%
Increase—293%	445%

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Economic Agriculture, A Reality at Last?

By Ivan E. Miles

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I AM an optimist by nature and sincerely hope always to be able to see the better side of life. I am also a realist and at times I want to shut myself away from the world for the specific purpose of looking at myself and doing some thinking. I do not believe that I am terribly dumb or very brilliant. I am neither very young nor very old. Life has been very good to me and so I should not be, nor do I think I am, sour on the world. I have lived outside my native state long enough to properly appreciate it and have come home to settle down. It has been my privilege to see something of agriculture in every state in the Union and in a number of places outside. The things that I shall point out in my native state are true in varying degrees everywhere I have been.

It is my opinion that Mississippi has promise of making as much or more progress in the next 10 years as any state in the Union. I think there has never been a time anywhere when the people were so genuinely ready to do something as the farmers of Mississippi are today. But help me face my responsibilities as Extension Agronomist in a state where 75 per cent of the agricultural income is from crops included within my sphere of responsibility. Perchance, you will have a fleeting moment from time to time to take a back-handed sort of glance at yourself.

We certainly will not have time to exhaust the field but let's look at me, as a paid agricultural worker, and then let us think of just a few phases of agriculture.

Corn

The corn production average for 1949 was 23 bushels per acre, which is about 50 per cent above the 1939-1944 average. Even at 23 bushels, however, if prevailing local prices are paid for labor for man and mule, for rent, seed,

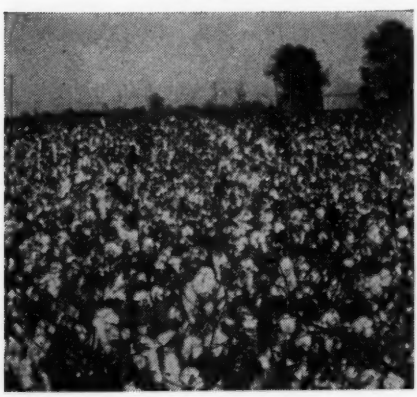
Figs. 1, 2. We can easily double our State average yield of corn.

depreciation of tools, fertilizer, and everything and the corn were sold for the current local price of $1.20 per bushel, the farmer would lose $6.10 per acre, not on one acre but on the state average, covering approximately 2¼ million acres of corn. That is to say, if the farmer is paid a living wage for his time he loses $6.10 per acre on the corn grown.

This would be sad indeed if nothing could be done about it. Luckily, however, such is not the case at all. Through the corn-breeding program under the able supervision of R. C. Eckhardt [1] and others, high-producing adapted varieties for most areas of the state are readily available. By using these adapted varieties, Howard Jordan [2] has very capably shown that with proper fertilization, stand, and other improved practices, excellent yields can be obtained. If Mississippi farmers would take this information secured by these men and apply it, the state average could easily be 50 bushels instead of 23. This could be done by following seven simple steps: 1. Grow on land adapted to corn; 2. prepare seedbed well; 3. select recommended variety or hybrid; 4. fertilize properly; 5. plant thick; 6. control weeds; 7. protect from pests.

Instead of losing $6.10 per acre as true for 23 bushels, 50 bushels would net a profit of $12.65 per acre above labor and all other costs, or to state it another way, corn cost $1.42 per bushel when only 23 bushels per acre are produced against a cost of $.95 per bushel on 50 bushels per acre. This is not guesswork, but is based upon many experiments and thousands of actual field trials. Actually when the farmer uses all his corn and has to buy, it will cost him considerably more than allowed in these calculations. Furthermore, the only way to make money growing corn is to sell it through livestock.

[1] Agronomist, Division of Cereal Crops and Diseases, U. S. Department of Agriculture.



Figs. 3, 4. Where approved practices are followed good cotton can be grown.

Cotton

Perhaps a better job is being done in growing cotton than any other crop, but a recent survey has been made, and based on present price structures this survey showed that if all known facts in producing, harvesting, and marketing cotton were used there would be an average net profit of $75 more per acre than at present. On two million acres [3] this would amount to $150,000,000 or almost $500 for every farmer in the state. This means $500 more than he now gets. This information also lends itself to seven easy steps: 1. Plant on land adapted to cotton; 2. fertilize properly; 3. use adapted varieties (One-

[2] Soil Scientist, Division of Soil Management and Irrigation, U. S. Department of Agriculture.

[3] In 1949 there were 2,800,000 acres in Mississippi.

Variety Community); 4. use labor effectively; 5. control insects and diseases; 6. pick and gin for high-grade cotton; 7. sell on grade, staple, and variety value.

Every one of these steps is important and should be provided. For instance, everything can be done correctly except controlling weevils and yet certain years the weevil infestation will be so serious as to destroy completely the crop regardless of whatever else is done.

Today, successful farming depends upon a completely unitized and coordinated program covering every phase of the crop from the selection of the seed and the land upon which those seed will be planted all the way through the marketing of that crop. If we will apply the information contained in the 7-step program, we can average a bale of cotton to the acre instead of the one-half bale secured in 1949.

Pasture

Pasture building has grown phenomenally during the last three or four years, but 2,250,000 acres of pasture are only a good beginning and many of these are not fully developed. We can take the information available and easily double the carrying capacity of our pastures and extend the grazing period from the average of 6 months to 12 months per year.

Fertilizer

In this warm climate and with an abundant rainfall, organic matter content in the soil is kept at a relatively low status and much plant food is lost by erosion and leaching. Consequently, our soils are comparatively low in productivity. Therefore, large amounts of fertilizer are an absolute essential in successful farming. If other approved practices are followed and the proper kind and amount of fertilizer are used on the major crops of Mississippi, every dollar spent on fertilizer will yield a net profit of a minimum of $3. That is a pretty good investment in anybody's language. Yet, far and large, the average farmer knows little about fertilizers. Generally speaking, he understands very little about the function, behavior, and action of plant foods and therefore is at a very distinct disadvantage to know what kind and how much to supply and how to secure proper balance between the various plant foods on a given soil for the crop to be grown.

While thinking of efficiency in the use of fertilizer, and perhaps lime should also be added, it might be well to raise the questions, "How does the farmer decide whether he needs lime and if so how much? How does he decide on what fertilizer to use and how much?" They are often purchased on the basis of hearsay or on brand

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Figs. 5, 6. What do you think the black cow is thinking?

Know Your Soil

II. Evesboro Loamy Fine Sand

III. Sassafras Sand

By J. B. Hester, F. A. Shelton, and R. L. Isaacs, Jr.

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THE climatic conditions that existed at Cinnaminson, N. J., in 1949 and the resulting differences in yield of tomatoes treated similarly prompted a study of the three soil profiles located within one mile of each other to ascertain information about the relative soil conditions that made possible the differences in yield. The Delanco soil, the first one described in the series, produced 102 bushels of corn, 15 tons of tomatoes, and 78 bushels of oats per acre. The Evesboro loamy fine sand produced 11.48 tons of tomatoes and the Sassafras sand only 3.97 tons per acre. Excavations similar to that made in the Delanco were made in these soils, and the root systems were studied.

Soil samples were taken at each depth of soil and analyzed. The clay depth in the Evesboro occurred much below that of the Delanco, i. e., the clay became prominent at the 23- to 42-inch depth in the Delanco and between the 53- and 60-inch depth in the Evesboro and was not found at the 60-inch depth in the Sassafras sand.

Using the conventional methods for determining the water-holding capacity, the Evesboro had the capacity of holding only 80 per cent of the amount held by the Delanco, and less than one-third of that amount was held by the Sassafras sand and at a much lower depth.

The characteristics of the Evesboro loamy fine sand, as shown in Table I,

TABLE I.—CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE EVESBORO LOAMY FINE SAND.

Horizon*	Depth inches	pH	Pounds per acre							% Organic matter	Water-holding capacity pounds	Per cent		
			CaO	MgO	Al	Nitrate nitrogen	P_2O_5	K_2O	Mn			Sand	Silt	Clay
A_p	0–7	6.9	2,800	90	1.7	1.4	60	194	T	1.5	571,200	89	4	7
A_{ps}	7–10	5.8	125	35	5.9	3.4	31	150	T	0.8	290,800	90	4	6
A_2	10–24	5.0	86	14	10.8	7.8	0.5	115	T	0.2	1,154,400	91	3	6
B_1	24–32	5.4	99	21	13.2	5.8	0.3	126	T	0.2	591,200	91	3	6
B_2	32–39	5.5	140	50	8.6	8.6	1	129	T	0.1	578,400	92	2	6
B_3	39–53	5.1	30	23	15.6	5.0	0.3	123	T	0.1	1,269,200	90	5	5
C	53–60	4.7	18	50	14.8	4.4	0.3	95	T	0.2	728,400	45	31	24

*A_p Brownish gray loamy fine sand; A_{ps} Light yellowish gray loamy fine sand; A_2 Brownish yellow loamy fine sand; B_1 Grayish yellow to yellow sand; B_2 Mottled light gray and reddish brown sand; B_3 Mottled grayish white and reddish brown sand; C Light brown and brownish yellow mottled sandy clay.

indicate a soil well supplied in calcium and magnesium in the top layer, but poorly supplied below. It was also very acid in the lower depths, which undoubtedly contributed very much to the unfavorable conditions for root growth. Available potash was fairly uniform throughout all depths, but the organic matter was low. Available potash was probably not being utilized in the lower depths of soil because of the unfavorable conditions for root growth. A plow sole had been developed between the 7- and 10-inch depth, but apparently was affecting the yield less than the extremely acid condition and the lack of water-holding capacity. Figure 1 shows the profile, the development of the plow sole, and the formation of the clay subsoil.

The leaching of nitrate nitrogen from this soil is extremely important as is shown by the tile drain in Figure 2. All during the months of June and July, six of these tile drains from the field were pouring out nitrate nitrogen at the rate of 47 to 60 parts per million and potassium at the rate of 15 to 18 parts per million. This makes nitrogen and potash fertilization on this soil important. A study of these facts points out the potential crop-producing power of this soil. Undoubtedly irrigation would be worthwhile under some conditions. On the other hand, care should be exercised in applying fertilizer so as not to lose it by leaching.

Sassafras Sand

It was difficult to excavate the Sassafras sand to get satisfactory studies because of the caving nature of the soil. While this soil is low in organic matter and without a satisfactory pH value and nutrient supply, it is perfectly obvious that the water-holding capacity in comparison with the formerly discussed soils is extremely low. The data in Table II characterize the nutritional status of the soil.

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Fig. 1. Evesboro profile.

Fig. 2. Leaching from Evesboro soil.

TABLE II.—CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE SASSAFRAS SAND.

Horizon*	Depth inches	pH	Pounds per acre					% Organic matter	Water-holding capacity pounds	Per cent		
			CaO	MgO	Al	P_2O_5	K_2O			Sand	Silt	Clay
A_p	0–10	5.5	136	12	T	33	86	0.5	477,000	88	6	6
A_2	10–33	5.7	125	11	N	7	24	0.2	581,000	93	2	5
B	33–60	5.9	100	9	N	3	44	0.1	696,000	94	2	4
C	60–	6.0	100	15	N	5	24	0.1	232,000	94	2	4

*A_p Grayish brown loamy sand; A_2 Yellowish brown sand; B Reddish yellow sand; C Yellowish red sand.

Fig. 1. Crimson clover was seeded on this field of sericea in the fall of 1948 on the farm of A. T. Harrison, Munford, Ala., and was in bloom when photographed, April 25, 1949. See Fig. 2.

Year-round Green

By R. Y. Bailey

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FARMERS in the South are learning to keep land green in summer and winter. To do this, they are using perennial summer legumes and grasses in combinations with annual reseeding winter legumes and grasses. This double cropping system keeps the land fully protected and gives a long season of grazing for livestock.

Sericea, kudzu, Johnson grass, Coastal Bermuda grass, and the narrowleaf Bahia grasses (Pensacola and Wilmington) are the most widely used perennials. Tall fescue has been seeded on several sericea fields and has shown much promise. Reseeding crimson clover, wild winter (also called Caley and Singletary) peas, grandiflora vetch, manganese bur clover, Italian ryegrass, and rescue grass are winter annuals that have shown most consistent ability to volunteer in thick stands when grown in combination with a perennial grass or legume.

Sericea and reseeding crimson clover have made excellent ground cover and furnished a long season of grazing at several experiment stations and on a large number of farms. This combination has grown well on soils ranging

Fig. 2. Sericea came back in a vigorous stand after the crimson clover shown in Fig. 1 matured seed. Another thick stand of crimson clover came in after frost killed the sericea in the fall of 1949. Field photographed July 26, 1949.

from heavy clays to deep, loamy sands.

Best results have followed where sericea was seeded a year or two before crimson clover was planted. Medium late dates of seeding, about October 15 in the middle South, have given better stands of clover than very early planting. Inoculated clover seed has been sown on sericea stubble following mowing or grazing. Seed was covered lightly by a section harrow or similar implement. Good stands also have come from seeding on the surface without any covering.

Farmers who have used sericea and reseeding crimson clover on the same land like this mixture for pasture. H. Owen Murfee, Jr., Prattville, Ala., is one of several farmers in that locality each of whom has several hundred acres of upland planted to this mixture. He reported 340 days grazing per year from this mixture, which is a very long season for an upland pasture to furnish feed. An increasing number of farmers in several Southeastern States are planting a high percentage of their upland pasture land to sericea and are sowing crimson clover the following fall or in the fall of the second year.

Like all new mixtures, this one requires some special management. Several farmers already have found that where this double cropping with legumes was practiced, the accumulation of nitrogen stimulated summer weed growth. Owen Murfee is trying rescue grass, tall fescue, and Harding grass in mixtures with reseeding crimson clover on sericea. He believes these grasses will use the extra nitrogen and reduce weed growth the next summer.

Results in the Land Utilization Project of the Soil Conservation Service at Dalton, Ga., at the State Hospital farm, Goldsboro, N. C., and on a number of farms in several different states have indicated that rescue grass will volunteer fairly consistently in such mixtures without the land being disked.

Italian ryegrass grows vigorously and

produces a large amount of good winter pasture when grown in mixture with reseeding crimson clover. It usually volunteers best where the surface of the soil is disked in late summer. Annual disking of sericea land is not a good practice because the disks injure the sericea plants and thin the stand.

Uses of Tall Fescue

Tall fescue has been sown on land after a stand of sericea was one or more years old and has made satisfactory growth wherever the grass seed was drilled an inch or a little less into the soil in the fall while there was a good supply of soil moisture. A few cases have been observed where sericea and fescue were sown together early in the spring and good stands of both developed. It is usually better, however, to seed the fescue on land where sericea has grown one or more years and built up organic matter and nitrogen in the soil. Fescue plants have developed somewhat more slowly on sericea than on other areas where a good seedbed was prepared and liberal amounts of nitrogen fertilizer were applied. Fescue on sericea has made exceptionally good growth the second year, after its roots were well developed.

Fescue plants usually have failed to survive the first summer drought where sericea was neither grazed nor mowed. For this reason, it is advisable to confine fescue seedings on sericea to areas that are to be pastured or mowed for hay. It does not fit well in a system where sericea is grown primarily for seed. A few plantings have been observed where tall fescue and a reseeding legume like crimson clover or wild winter peas both were sown on sericea land. The mixture has looked promising to date, but more time will be needed to get any final answers on such combinations.

Wild winter peas have been seeded on several established stands of sericea, and this legume has added to the density of the ground cover in winter and furnished good pasture in late winter and spring. Press Adams, Anniston, Alabama, pastures dairy cows on a combination of wild peas and sericea on part of his land and on another part he uses reseeding crimson clover and sericea. He gets good results from both reseeding winter legumes.

Good results with wild peas and sericea have been observed at several places in Mississippi. The commissioners of the Newton County Soil Conservation District bought a small, eroded hill farm and planted the cropland fields to different mixtures. Wild winter peas and sericea were used in one field for spring and summer hay. Peas were harvested for hay early in the spring and sericea in the summer. Observations there and elsewhere have shown that wild peas bedded down in the spring and did considerable damage to the stand of sericea if neither grazing nor mowing was practiced. The kind of mowing is important. Very close mowing prevented peas from making seed. Where the cutter bar was set to leave stubble about five inches high, enough short vines were left to make plenty of seed for reseeding.

Other Grass-legume Combinations

Another combination that is being tried under nursery conditions is a summer mixture of sericea and Pensacola Bahia grass and a winter cover of either reseeding crimson clover or wild winter peas. Sericea and Bahia grass have grown well in mixtures on small areas of the Soil Conservation Service nursery at Americus, Ga. Both reseeding crimson clover and wild winter peas have grown well as winter covers on Bahia grass. Combinations of these plants may give us green cover and a long season of grazing on sandy uplands. Such combinations are mentioned here only as possibilities that as yet have not been fully tested in our observational nursery program. A few observational seedings of sericea and Wilmington Bahia grass also have been made on farms.

Grazing management is an important

Fig. 3. Reseeding crimson clover was sown on a sod of Coastal Bermuda grass at the SCS nursery, Thorsby, Ala., in the fall of 1948. This good growth was photographed May 3, 1949. A volunteer stand of clover came up after Bermuda grass was killed by frost in the fall of 1949.

part of these double-cropping systems with sericea and other plants. Best volunteer stands have come in the fall where sericea was mowed for hay or grazed fairly closely in late summer. Where very dense sericea was left uncut, volunteer stands of the winter plants often were late and thin. Likewise, sericea needs protection in the spring. As pointed out in connection with wild winter peas, very dense growth of one of the reseeding legumes that is neither grazed nor mowed for hay sometimes tends to mat down and smother sericea plants.

Where reseeding annuals are pastured in the winter and spring, it is necessary to regulate the rate of stocking so that these plants will make seed. In mixtures that include wild winter peas, stock should be taken off before the seed pods begin to fill. The seed of this legume contains an alkaloid that is toxic to livestock. Animals that were left in the fields where peas were making seed sometimes became stiff in their hindquarters. These animals usually recovered when moved to other pasture.

Proper grazing management of sericea also is important. Several fields where good stands of sericea were weakened and thinned by continuous close grazing have been observed. Sericea is like other plants in that both roots and tops are necessary for normal growth. Excessive grazing, therefore, reduces the amount of feed produced, in addition to weakening the stand of sericea.

Another combination that keeps the land covered with green plants and makes good pasture is Johnson grass and wild winter peas. Sometimes farmers use the peas for winter and spring pasture and harvest the Johnson grass for hay in the summer. Press Adams at Anniston, Ala., has this combination and his spring grazing and summer hay show that this is a highly productive combination. Nitrogen from

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Fig. 4. Dairy cows grazing a mixture of Caley peas and vetch on a sericea field on Press Adams' farm, Anniston, Ala. Photographed April 26, 1949.

Fig. 5. Sericea made good summer growth after the winter legumes shown above matured seed. Photographed July 26, 1949.

Fig. 6. Caley peas made good late winter and spring grazing on a Johnson grass field on Press Adams' farm, Anniston, Ala. Photographed April 26, 1949.

Fig. 7. This dense growth of Johnson grass followed the Caley peas shown above in Figure 6. Photographed July 26, 1949.

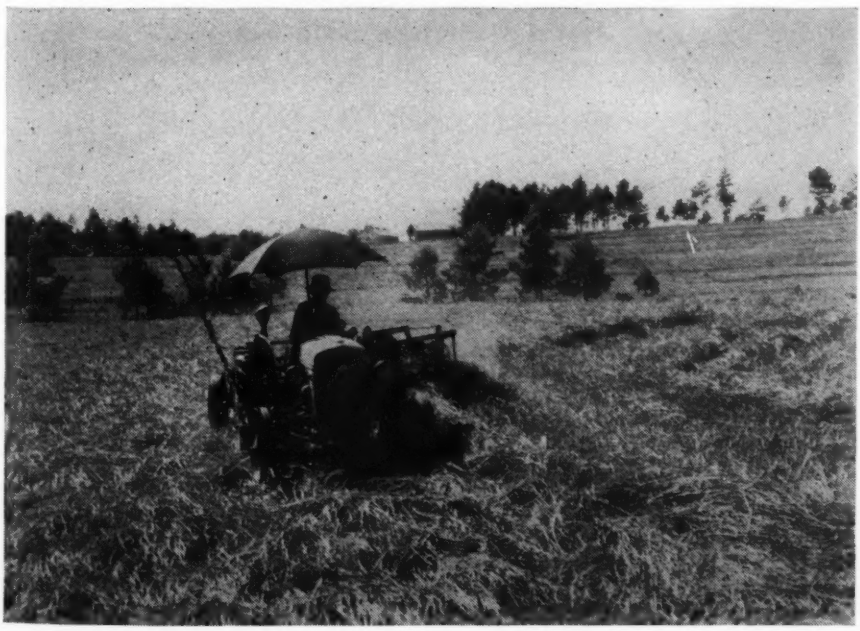


Fig. 8. Caley peas sown on Coastal Bermuda grass at the SCS nursery, Thorsby, Ala. Photographed May 3, 1949. A thick stand of peas came up on this area in the fall of 1949.

Fig. 9. A volunteer stand of reseeding crimson clover on kudzu at the SCS nursery, Thorsby, Ala. Photographed May 3, 1949. Another volunteer stand came up in the fall of 1949.

Fig. 10. Caley peas were sown on kudzu on F. E. Williams' farm, Columbiana, Ala., in the fall of 1941 and have volunteered each fall since. Photographed April 26, 1949.

Fig. 11. Growth of kudzu that will make good fall pasture on same field shown above. Photographed July 26, 1949. Kudzu was followed by another stand of peas.

Fig. 12. Caley peas on a kudzu field furnished excellent late winter and spring pasture on W. J. Bailey's farm, Montevallo, Ala. Photographed April 26, 1949.

Fig. 13. Kudzu, on the field above, made enough growth to produce over a ton of hay per acre after the peas matured seed. Hay was being cut when photographed July 26, 1949.

The Editors Talk

Elastic Fertility

Some plant nutrients, principally nitrogen and water, are mobile and will find their way to the plant roots. Other nutrients, chiefly phosphorus and potassium, except in very sandy soils are largely immobile and tend to stay where they are put. To be used, they must be found by the plant roots. It is on these facts, together with knowledge of rooting habits of the different crops, that all of the research on fertilizer placement has been based.

According to Roger H. Bray, Professor of Soil Fertility, Illinois Agricultural Experiment Station, in the book DIAGNOSTIC TECHNIQUES FOR SOILS AND CROPS, fertile soils are soils which, except for nitrogen and water, have a large reserve of nutrients already present in available forms—forms which can be used by the plant roots when the roots reach them. It is these reserves, accumulated in the past as a result of previous treatments or natural processes, that are responsible for fertility in soils. The yearly release of nutrients from unavailable forms has, except for nitrogen, only a minor effect on the immediate crop, although it can have a major effect on maintenance of fertility over a long period.

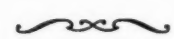
Because these nutrients are relatively immobile, their availability to plants is limited by the nature of the plant, particularly the density and extensiveness of the rooting system. The roots must go out and forage for the immobile nutrients, continually sending out new roots as the older ones exhaust the effective feeding zone.

Dr. Bray states that an "elastic" availability of the immobile forms is made possible by the large amounts present. Even in a deficient soil the amounts are several times larger than can be used by a single crop. But the immobile forms have a very indefinite availability to plants. Favorable seasons, favorable physical soil conditions, and good varieties all help produce higher yields, which require the uptake of larger amounts of nutrients. It is the larger, denser, and more efficient root system produced by these more favorable conditions that makes it possible for the plant to forage for the large amounts of nutrients needed. Although varying amounts of a nutrient can be absorbed from any level of supply, maximum yields are impossible if that supply is low, since the deficiency cannot be overcome by making the other conditions more favorable. This is because the plant is influenced by all factors determining its growth. If for example, potassium is only 80 per cent sufficient for a given crop it will restrict yields by about 20 per cent over a wide range of fertility. The higher yields take out more potash but will still be 20 per cent lower than what could have been produced with adequate potash. In the face of an added deficiency, say only enough phosphorus for a 60 per cent maximum yield, the 80 per cent supply of potassium would bring the yield down to 80 per cent of 60 per cent or 48 per cent of a full crop.

This illustrates, according to Dr. Bray, what is meant by elastic availability

of the immobile nutrients, which enables them to work with a similar percentage of effectiveness at different productivity levels. It could only work where the total immobile supplies of the available forms are, even in deficient soils, in excess of the needs of any one crop. This seeming anomaly is due to the fact that no one crop during a single season could remove the total supplies of immobile but "available" nutrients. In a way this is nature's method of preventing the total depletion of a soil.

In this is the explanation of why there may be little or no response from an application of a plant-food element when there is a deficiency of one or more of the others. It argues well for a more universal use of soil tests. Dr. Bray has estimated that in Illinois alone $5,000,000 worth of fertilizer has been wasted by farmers who didn't test their soils and put on something that wasn't needed. On the other hand, the ones who have tested have saved about $4,000,000 by using the kind of fertilizer they needed, in the amounts needed, and where it was needed.



The Value of a Good Farm Wife

With spring "busting out" all over, garden soils are being turned and the air is full of the cheeping of young poultry. Perhaps at no time of the year does a busy farmer appreciate more the services of a good farm wife. Between her housecleaning and hundreds of other household chores, she manages to save him countless steps and laborious details which are so time-consuming in the rush of spring work.

What is the value of a good farm wife? There was a time back in the colonial period between the years 1619 and 1621 when a farmer could secure a wife for about $36. This came about through the importing by governing officials of "young and uncorrupt" maidens as mates for the settlers. The charge to the settler after he had chosen his maiden was 120 pounds of tobacco to pay for her transportation across the sea.

We have come a long way from colonial values and it is not surprising to learn that a good farm wife is now considered to be worth $60,000. M. L. Mosher, Extension Farm Management Specialist at the Illinois College of Agriculture, has figures to show that the average farm wife is worth that amount in extra income to her husband and family during their married life.

He gets the figure from a study of farm earnings on 240 north-central Illinois farms for the 10 years, 1936-45. A few of the operators were bachelors. They earned on the average $2,400 less in net earnings each year than the married farm operators. Yet both groups operated the same general size and type of farm. This $2,400 difference capitalized at four per cent amounts to $60,000. If you multiply the $2,400 difference each year by 35 years of married life, the figure would jump to $84,000. Mr. Mosher, however, does not assure bachelors that marriage will automatically guarantee successful farming and $60,000 more income. But he believes that having a wife does help.

And so—hats off to the farm ladies. We all know many whose worth could not be measured in dollars. Their inspiration to home and community life are intangibles upon which it would be difficult to put a value and which have contributed so greatly in making American agriculture the basis of this nation's prosperity and well-being.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay[1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925.....	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945...	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946...	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948	31.0	38.7	153.0	219.0	136.0	205.0	19.00	67.80	....
1949									
April.....	29.91	24.7	181.0	275.0	122.0	200.0	19.00	50.30	....
May.....	29.97	32.5	181.0	273.0	122.0	200.0	17.70	50.40	....
June.....	30.13	31.5	175.0	264.0	121.0	186.0	16.40	46.70	....
July.....	30.08	56.5	155.0	283.0	125.0	182.0	15.65	37.50	....
August.....	29.32	44.6	154.0	267.0	118.0	179.0	16.05	44.40	....
September...	29.70	48.7	138.0	230.0	116.0	187.0	16.25	43.50	....
October.....	28.70	47.4	130.0	196.0	109.0	189.0	16.75	41.80	....
November...	27.76	43.4	134.0	189.0	102.0	190.0	16.75	42.30	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January.....	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February....	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March.....	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....

Index Numbers (Aug. 1909—July 1914 = 100)

1925.....	158	168	245	188	109	163	108	140	143
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	224
1946.....	263	382	178	248	212	209	141	319	204
1947.....	257	380	232	248	336	259	148	381	249
1948.....	250	387	220	249	212	232	160	301	238
1949									
April.....	241	247	260	314	190	226	160	223	236
May.....	242	325	260	312	190	226	149	224	213
June.....	243	315	251	301	188	210	138	207	175
July.....	243	565	222	323	195	206	132	166	185
August.....	236	446	221	305	184	202	135	197	174
September...	240	487	198	263	181	212	137	193	205
October.....	231	474	187	224	170	214	141	185	170
November...	224	434	192	216	159	215	141	188	213
December....	214	454	188	230	176	218	144	192	196
1950									
January	213	397	195	245	179	217	144	193	201
February....	222	341	191	252	181	218	141	193	203
March.....	226	320	189	253	185	224	139	191	168

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4 40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2 67	2.30	7.06	6.63	4.92	6.00
1929	2 57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1 81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1 87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1 97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	10.11	10.59	10.84	9.85
1949						
April	3.19	2.27	9.22	12.36	9.71	9.87
May	3.19	2.27	9.43	12.36	9.71	9.11
June	3.19	2.28	9.65	13.34	10.02	9.71
July	3.19	2.32	11.07	14.97	11.53	10.78
August	3.19	2.32	11.88	14.49	12.75	12.14
September	3.19	2.32	9.83	14.53	11.53	11.53
October	3.08	2.32	9.94	14.58	11.29	11.65
November	3.00	2.32	10.39	14.21	10.39	10.78
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10 26	10 08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
Index Numbers (1910-14 = 100)						
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949						
April	119	80	263	350	288	280
May	119	80	269	350	288	259
June	119	80	276	378	297	276
July	119	81	316	424	342	306
August	119	81	339	410	378	345
September	119	81	281	412	342	328
October	115	81	284	413	335	331
November	112	81	297	403	308	306
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.498	.706	18.93	.195
1948	.764	4.27	6.60	.478	.681	14.14	.195
1949							
April	.770	3.85	7.06	.375	.720	14.50	.200
May	.770	3.85	7.06	.375	.720	14.50	.200
June	.770	3.66	7.06	.330	.634	12.76	.176
July	.770	3.60	5.87	.353	.679	13.63	.188
August	.770	3.60	5.47	.353	.679	13.63	.188
September	.770	3.65	5.47	.353	.679	13.63	.188
October	.770	3.75	5.47	.375	.720	14.50	.200
November	.770	3.76	5.47	.375	.720	14.50	.200
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200

Index Numbers (1910-14 = 100)

1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949							
April	144	107	145	68	76	60	83
May	144	107	145	68	76	60	83
June	144	101	145	62	67	53	80
July	144	100	120	65	71	56	82
August	144	100	112	65	71	56	82
September	144	101	112	65	71	56	82
October	144	104	112	68	76	60	83
November	144	104	112	68	76	60	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925.....	156	153	151	112	100	131	109	80
1926.....	146	150	146	119	94	135	112	86
1927.....	141	148	139	116	89	150	100	94
1928.....	149	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	123	130	127	86	56	130	102	77
1942.....	158	149	144	93	57	161	112	77
1943.....	192	165	151	94	57	160	117	77
1944.....	196	174	152	96	57	174	120	76
1945.....	206	180	154	97	57	175	121	76
1946.....	234	197	177	107	62	240	125	75
1947.....	275	231	222	130	74	362	139	72
1948.....	285	250	241	134	89	314	143	70
1949								
April.....	256	244	229	134	99	291	144	72
May.....	253	244	227	134	99	293	144	72
June.....	249	242	223	134	99	304	144	65
July.....	246	240	225	140	100	349	144	68
August....	244	238	222	143	100	372	144	68
September.	247	238	225	138	100	334	144	68
October...	242	237	222	138	98	331	144	72
November.	237	236	221	136	96	321	144	72
December..	233	237	221	136	96	317	144	72
1950								
January...	235	238	221	135	96	316	142	72
February..	237	237	223	132	96	286	142	72
March....	237	239	222	134	96	305	142	72

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

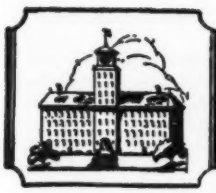
† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**



REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Commercial Fertilizers, Report for 1949," Agr. Exp. Sta., New Haven, Conn., Bul. 534, Dec. 1949, H. J. Fisher.

"Fertilizer Analyses—Fall 1949," Kansas State Board of Agr., Control Div., Topeka, Kansas.

"Louisiana Fertilizer Report, 1948-1949, Fertilizer Consumption, Fertilizer Recommendations, Fertilizer Analyses," La. Dept. of Agr., Baton Rouge, La., E. A. Epps, Jr.

"1950 Fertilizer Recommendations of the Louisiana Experiment Station," Agr. Ext. Serv., Baton Rouge, La., M. B. Sturgis and R. A. Wasson.

"Maryland Fertilizer Facts for 1949," Inspection and Regulatory Service, College Park, Md., L. E. Bopst.

"Know Your Fertilizers," Ext. Serv., Miss. Sta. College, State College, Miss., I. E. Miles.

"More Efficient Use of Fertilizer," Agr. Exp. Sta., Univ. of Mo., College of Agr., Columbia, Mo., Bul. 531, Dec. 1949.

"New York Fertilizer Recommendations," Ext. Serv., College of Agr., Cornell Univ., Ithaca, N. Y., Cornell Ext. Bul. 780, L. R. Simons.

"Better Fertilizer Means Better Tobacco," Ext. Serv., Va. Polytechnic Institute and USDA Cooperating: Cir. 489, Jan. 1950, L. B. Dietrick.

"Fertilizers for Western Washington," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 386, Feb. 1950, S. C. Vandecaveye, H. E. Dregne, Karl Baur, C. D. Schwartze, D. F. Allmendinger, and D. J. Crowley.

Soils

"Studies on the Forms and Availability of Soil Organic Phosphorus," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Research Bul. 362, Aug. 1949, C. A. Bower.

"Terracing to Save Soil," Agr. Ext. Div., College of Agr. and Home Econ., Univ. of Ky., Lexington, Ky., Cir. 473, J. L. McKitrick.

"Taking Soil Samples," Ext. Serv., Okla. A. & M. College, Stillwater, Okla., Cir. 513, R. O. Woodward.

"The Conservation of Calcium and Magnesium from Inputs of Burnt Lime, Limestone, Dolomite, and Dicalcium Silicate, As Influenced by Rate and Frequency of Liming and by Zone of Incorporation," Agr. Exp. Sta., Va. Poly. Inst., Blacksburg, Virginia, Tech. Bul. 112, July 1949, W. W. Shaw, W. H. MacIntire, and H. H. Hill.

"Release of Non-exchangeable Potassium in Hawaiian Sugar Cane Soils," Agr. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii, Tech. Bul. 9, Dec. 1949, A. S. Ayres.

Crops

"58th and 59th Annual Reports, Jan. 1, 1947-Dec. 31, 1948," Agr. Exp. Sta., Ala. Poly. Inst., Auburn, Ala., Jan. 1950, M. J. Funchess.

"Let's Make More and Better Peanuts," Ext. Serv., Ala. Poly. Inst., Auburn, Ala., Cir. 372, Jan. 1950, J. C. Lowery.

"Field Corn Report, Mt. Carmel and Windsor, Connecticut, 1949," Conn. Agr. Exp. Sta., New Haven 4, Conn., Rpt. of Prog. 49G2, Feb. 1950, D. F. Jones and H. L. Everett.

"Progress Report of Studies Concerned with Quality Cottonseed Production in the Coastal Plain Area," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Tech. Mimeo. Paper No. 2, Nov. 1949, J. H. Turner, Jr.

"Profitable Cotton Production," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Cir. 359, Jan. 1950, E. C. Westbrook, J. R. Pressley, and J. F. Forehand.

"Coastal Bermuda for Grazing and Hay," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Cir. 355, Jan. 1949, E. D. Alexander, J. B. Preston, and J. R. Johnson.

"Plans and Plantings for Georgia Homes," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Bul. 402, June 1949, H. W. Harvey.

"The Use of Hotbeds in Early Sweet Potato Plant Production," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 69, Jan. 1950.

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"Better Farming with a Legume-Grass Program," Agr. Ext. Serv., College of Agr., Univ. of Ill., Urbana, Ill., Cir. 649, Oct. 1949, H. P. Rusk.

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"Some Items of Interest to Kentucky Nurserymen for the Year Ended June 30, 1949," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 75, Sept. 1949, W. A. Price and H. G. Tilson.

"Pasture Renovation," Univ. of Md., College Park, Md., Mimeo. 16, Jan. 6, 1950, T. B. Symons.

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"Plantations of Northern Hardwoods," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 853, Nov. 1949, E. F. Wallihan.

"Growing Pumpkins and Squashes," College of Agr., Cornell Univ., Ithaca, N. Y., Cornell Ext. Bul. 776, Sept. 1949, E. V. Hardenburg, C. Chupp, and R. W. Leiby.

"North Dakota's Agricultural Progress Through Research, Annual Report of the N. D. Agricultural Experiment Station," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Sta. Bul. 356, Jan. 1950, H. L. Walster.

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"Cotton Growing in Eastern Oklahoma, A Comparison of Present Methods and Recommended Practices," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. No. B-345, Feb. 1950, W. F. Lagrone.

"Controlling Damping-off in Vegetable Seedlings," Agr. Exp. Sta., Oreg. State College, Corvallis, Oregon, Cir. of Inf. No. 447, (Rev. of S.C.I. No. 305) Jan. 1949, E. K. Vaughan.

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"Fertilizing Vegetable Crops in Pennsylvania," Agr. Exp. Serv., Pa. State College, State College, Pa., Cir. 324, Jan. 1949, J. H. Boyd and J. O. Dutt.

"The 1949 Cotton Contest for Better Quality and Higher Yields," Ext. Serv., Clemson Agr. College, Clemson, S. Car., Cir. 348, Jan. 1950, H. G. Boylston.

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"Plant Diseases in Texas and Their Control," Agr. Exp. Sta., Texas A. & M. College System, College Station, Texas, Cir. 124, Dec. 1949, A. A. Dunlap.

"More Profit from Your Cotton," Ext. Serv., Va. Poly. Inst., Blacksburg, Va., Cir. 491, Jan. 1950, L. B. Dietrick.

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Economics

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"Connecticut Crop, Livestock and Marketing Review for 1948," Dept. of Farms and Mkts., Sta. Ofc. Bldg., Hartford, Conn., Bul. 105, Dec. 1949, Div. of Mkts.

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"A Progress Report on Factors Affecting Farm Earnings on 81 Farms Raising Grass Seed or Having Improved Pastures, Willamette Valley, Oregon, 1948," Agr. Exp. Sta., Oreg. Sta. College, Corvallis, Oregon, Cir. of Inf. 459, Aug. 1949, M. H. Becker, E. A. Hyer, and D. C. Mumford.

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"Economic Land Classification of Wythe County," Agr. Exp. Sta., Blacksburg, Va., Bul. 422, Aug. 1949, G. W. Patteson and Z. M. K. Fulton, Jr.

"Keeping Up on the Farm Outlook," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 147, Feb. 28, 1950, K. Hobson.

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Potash Helps Keeping Quality of Cabbages and Tomatoes

By Clyde Beale

Associate Extension Editor, Gainesville, Florida

THAT potash fertilization has a significant bearing on the storage quality of cabbage and handling and shipping quality of tomatoes has been indicated in research by Dr. Raymond A. Dennison, Florida Agricultural Experiment Station Horticulturist, and Dr. Byron E. Janes, former Florida Station Horticulturist now with the Connecticut Experiment Station.

Drs. Dennison and Janes also found that muriate of potash was better than sulphate of potash or nitrate of potash for cabbage, while sulphate of potash proved superior to muriate or nitrate of potash for tomatoes.

In their investigations with cabbage, they applied fertilizer at the rate of one ton per acre, but varied the amounts and kinds of potash for different plots. To one plot they applied a 5-7-5 mixture, with the potash in the form of muriate; to another they applied a 5-7-10 mixture, also using muriate of potash; to a third and fourth plot, they applied mixtures of the same percentages, using nitrate of potash; and they followed the same procedure with two more plots, applying 5-7-5 to one and 5-7-10 to the other, using sulphate of potash. To a check plot they applied a no-potash fertilizer, 5-7-0, at the rate of one ton per acre.

There were only small differences in yields from all the plots, but the cabbage harvested from the plantings which received the fertilizer containing muriate of potash stood up better in storage of 47° Fahrenheit over a period of two months than the crops from the plot which received no potash and the plots receiving nitrate and sulphate of potash. Heads from the plots which received muriate of potash were firmer and were of all-round higher quality than those from the

other plantings, and heads from the plot which received the mixture containing 10 per cent muriate of potash were superior to those from the plot receiving 5 per cent.

In their tests with tomatoes, Drs. Dennison and Janes applied fertilizer at the rate of 2,500 pounds per acre to their plantings and followed the same procedure as they did with their cabbage—no potash (5-7-0) and 5-7-5 and 5-7-10. The sources of potash they used were the same—muriate, nitrate, and sulphate of potash—and the variations in kind and percentage of potash in fertilizers they used were the same.

With tomatoes, sulphate of potash proved superior. The plants which received no potash produced an average of 341 bushels per acre, while those which received potash produced 452 bushels per acre. Yields from the plantings receiving the various kinds of potash at 5 and 10 per cent levels did not vary to any appreciable extent.

After testing on a laboratory machine which simulates commercial handling and shipping conditions, however, tomatoes from the planting which received the mixture containing 10 per cent sulphate of potash (5-7-10) were markedly superior in quality to those from the other plantings, which also were tested.

The crop from the plot which received the 10 per cent sulphate of potash mixture was 71.4 per cent marketable, while that from the no-potash plot was only 47.1 per cent marketable, and the marketable portions of the crops from the plantings which received 5 to 10 per cent muriate of potash were only 51.6 per cent and 53.8 per cent, respectively. All crops were tested on the machine, and the general all-round quality of the tomatoes from the planting which received 10 per cent sulphate of potash was superior to those from the other plots.

Good Farmers Make Good Soils

"SOMEHOW the notion gets around," says Dr. Charles E. Kellogg of the U. S. Department of Agriculture, "that originally our farm soils were highly productive; that is, productive when first plowed. Many of them were like the black lands in our Middle West and in central Eurasia, for example, and in some of the great deltas and alluvial valleys. But most soils are not. It is through liming and fertilization, drainage, irrigation, the introduction of legumes, and a host of other practices, that farmers have made their soils productive," explains Dr. Kellogg who is Chief of the Division of Soil Survey in the Bureau of Plant Industry, Soils and Agricultural Engineering.

"After all," he continues, "this is the important thing; not the productivity when first plowed; but the response of soils to management systems. There is no more reason for saying that large areas in the tropics are without an agricultural future than there is for saying that large areas in the eastern United States and Western Europe are without an agricultural future, simply because one gets low yields in the absence of management practices that depend upon science and industry. Science and industry are within man's control."

Potash Production—A Progress Report

(*From page* 16)

This change in the distribution pattern is highlighted by what has happened in certain states. For example, during this nine-year period Ohio deliveries increased from 28,000 to 89,000 tons K_2O thus crowding Georgia for

first place in point of deliveries. Illinois showed an increase from 15,000 to 83,000; Indiana from 14,000 to 54,000; Wisconsin from 1,600 to 22,000 and Iowa from 330 to 13,400 tons K_2O.

These data are tabulated as follows:

TABLE III.—CHANGES IN POTASH (K_2O) DELIVERIES IN FIVE MIDWESTERN STATES.

	1940 Tons	1948 Tons
Ohio	28,000	89,000
Illinois	15,000	83,000
Indiana	14,000	54,000
Wisconsin	1,600	22,000
Iowa	330	13,400

Reflected in these figures showing increased deliveries is the progress being made agronomically in the wider and more diversified use of potash. With 95 per cent of the agricultural potash being retailed to the farmer as a constituent of mixed goods, its usage naturally follows that of mixed goods and that in turn, we have been taught, rises and falls with the farmer's gross income. Of the 12 million tons of mixed goods used during the year ended June 30, 1948, 66 per cent contained 6 units or less K_2O. This certainly reflects wide-spread distribution, but distribution after the ancient pattern of low potash mixtures. Included in the total tonnages, however, were 23 per cent of grades containing more than 6 units of K_2O with 9 per cent containing 12 units K_2O or more. The corresponding figures for 1947 are 18.6 per cent containing more than 6 units K_2O and 5 per cent containing 12 units or more.

Such grades and higher are to be found on the lists of recommendations by state agronomists in increasing numbers—recommendations based on research and demonstration in the improved fertilization of a long list of crops. Included conspicuously are the legumes, such as alfalfa, ladino clover, soybeans, and the grass-legume pastures, now so widely being adapted particularly in the South. There the economic importance of this development can scarcely be over-estimated as the foundation of a livestock industry based on 10 to 12 months grazing and frequently closely associated with soil conservation. This program is based essentially on lime, phosphate, and potash in adequate amounts. The farmer can buy his lime and phosphate as materials, but as a source of potash he cannot get by with 6 per cent K_2O mixtures. The agronomist insists that what he must have are grades such as 0-10-20, 0-9-27, or 50-60% muriate.

Of special importance is the new technique of corn production calling for radically increased, but still profitable, fertilizer applications, predominately nitrogen but with the essential balance of phosphate and potash. The economic importance of this new development to the South is easily visualized when it is recalled that corn acreage predominates there with a former average yield of some 16 bushels per acre now susceptible to being raised four-fold.

Education

In the past, reference was frequently made to the "time lag" between agricultural education and practice, spoken of as something that couldn't be helped and as an implied reflection on the farmer's intelligence. It would seem from a study of the agricultural literature, revealing rapid progress in farmer adoption of so many new practices, that this time lag has been greatly shortened and that the reason is two-fold—improved education and farm income sufficient to permit the farmer to adopt the practices taught by the educator.

As to farm income, that is a matter of statistics, as likewise is the farmer's willingness to spend dollars to buy plant foods in terms of his gross income even when his net income is shrinking. As to improved education there can be no question—more students studying

agriculture, better research, a vastly expanded demonstrational program by State and Federal agencies,—experiment stations, the extension and the soil conservation services, vocational agricultural schools, and veterans agricultural training programs.

In the field of education, the potash industry as represented by the three Member Companies of the American Potash Institute continues its contributions on an expanded scale through its endowment of research and its wide dissemination of educational material in various forms—books, the agronomic magazine, *Better Crops With Plant Food,* news letters, colored plant-food deficiency charts, motion pictures, etc. —totaling some 1,200,000 items issued during the past 12 months.

In summarizing this report on the American potash industry, progress is claimed in respect to expanded plant facilities and improved economies resulting in increased potash production and in the potash content of the tonnage produced. This increased refinement results progressively in the decrease in freight charges to be paid by the consumer—the farmer. With rising production costs there has been no rise in the price of the major product, 60 per cent muriate. Prospecting and exploration by new companies have expanded. Geographically, wider distribution of potash salts is being accomplished; and agronomically, as the result of education, potash use is being diversified and more scientific rates of application are being utilized.

Economic Agriculture . . .

(*From page* 19)

name or price basis without reference to plant-food content or balance or what is needed for the crop and soil concerned. Often there is a distinct prejudice against new and high analysis fertilizers, regardless of their value.

Then there are those 5,000,000 acres of idle land. They are doing little or nothing for anyone except growing broomsedge. This is a disgrace to me as an agricultural leader. We have no waste land in Mississippi. All of it, almost every acre, can be utilized so as to conserve and improve the soil and at the same time yield some income. After all of the other crop needs have been supplied, the remainder of the land can be planted to trees. Well-managed forest projects can be quite profitable in Mississippi.

Problem

What have we proposed? Every acre to the crop to which it is best adapted and much greater efficiency in the production of every major crop. Won't this put us into over-production? Not in any sense of the word! Reduce the acreage planted to corn by 50 per cent and double the yield per acre, maintaining the same total production as the present. This means over a million acres—hazardous acres—acres which have failed often because of poor drainage, overflow, excessively sandy or steep eroded shallow hillside soils—to come out of corn and be planted to forage crops, pastures, or trees. This million acres will cease to be a liability and loss but instead will start on the road to soil-building and finally become a real source of income. The same principles will hold on all acres taken from other crops.

Please keep all the above facts in mind and look again at the farmer. On the average his income is miserably low and his family larger than yours. The conveniences at home are not too good either for him or his family. His school, his roads, his hospital, his church, his community, in fact, just about everything could stand some im-

provement, but what can he do about it on his income? Yet his income could easily be doubled if he would use the information available to him as suggested above. Do you see what I am trying to say?

The man needs that money very badly, and I know how he can make more of it. He loves his family and thinks he is doing everything he can for it. I MUST get him to stop and think, to take inventory like any other business man. What does he have? Where does he want to go? Let us help him make plans to get there. Let us show him his land and crop adaptations, how to use all the research data pertinent to problems on his place, how to use soil testing and other experimental data as a basis for liming and fertilization.

Let us show him that money invested in lime where needed and in the proper amount and kind of fertilizer is not a waste but a very good investment. Let us help him plan his program well in advance, realizing that farming is a 12-month job; let us show him that there is work to do every day the same as the merchant, the postman, the banker has every day. Let us get him to take a short vacation and get away from the place and get some new ideas. It is my job to lead this farmer to do these things. He is paying me for that purpose. It is my job along with other specialists and 20 paid local agricultural workers in the average Mississippi county.

Before you go let us take a quick look at your situation. Are your farmers operating as efficiently as they could and should? If not, why aren't they? Do you see what I mean?

Know Your Soil . . .

(*From page* 21)

Figure 3 shows the root penetration of this soil undoubtedly making an extreme effort to obtain sufficient water. Another characteristic of this soil is the weakness for becoming magnesium deficient in years when leaching is a factor. Figure 4 shows extreme magnesium deficiency in corn produced on this soil when adequately fertilized with nitrogen, phosphorus, and potash.

The Sassafras sand is a good, early truck-crop soil if carefully managed, if irrigation is available, and if short-seasoned crops are grown.

Considerable interest is being displayed by the farmers in New Jersey in digging holes in their soil to determine some of the limiting factors. It is believed that without this information the best use of soil amendments, irrigation, and cropping practices cannot be made.

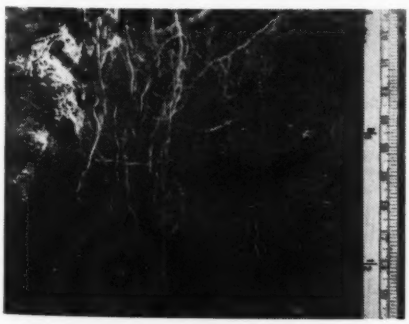

Fig. 3. Plant-root penetration in Sassafras sand.

Fig. 4. Magnesium deficiency frequently prevalent on sandy soils.

Year-round Green

(*From page* 25)

the peas has greatly increased the growth of his Johnson grass the following summer.

Johnson grass is seldom planted in the South because it is a weed pest on cropland. There are, however, many thousands of acres on which there is a thick stand of Johnson grass. The addition of wild winter peas greatly increases the pasture and hay from such land.

Coastal Bermuda grass and either reseeding crimson clover or wild winter peas make a combination that furnishes excellent pasture from about the first of December until frost kills the grass the following fall. The date that winter grazing begins depends largely on fall rainfall. When there is plenty of rain in September to get crimson clover started and then enough in October to keep the plants growing, grazing sometimes can be started as early as the first of November. When fall rain is lacking, clover often furnishes little grazing until after Christmas. Wild winter peas start a little more slowly than crimson clover and usually give little grazing until after Christmas.

Manganese bur clover has made excellent growth in combinations with Coastal Bermuda grass in the Coastal Plain of Georgia. Bur clover starts to grow early in the fall and makes early winter and spring grazing. It also beds down in a rather heavy mat if it is not grazed in late spring. This tends to smother the Bermuda grass and sometimes thins the stand.

Kudzu makes pasturage of good quality and is very useful during periods of dry weather in the summer and fall. It also grows well on rough, steep land. Kudzu gives almost complete protection against erosion and greatly increases the percentage of rainfall that is taken into the soil. It tends to suppress brush and certain weeds. This makes kudzu particularly desirable for land that is too rough for convenient mowing.

Kudzu usually is pastured only during dry summer and fall periods, and its grazing season is rather short. A winter crop that would volunteer each fall, keep the land green in the winter, and give a longer season of grazing would add much to the value of kudzu land. Several farmers have seeded wild winter peas on their kudzu land and have been pleased with the amount of late winter and spring pasture it has given.

F. E. Williams of Columbiana, Ala., planted kudzu on five acres of Montevallo shale in 1941. He seeded wild winter peas on this land in the fall of 1943 and peas have volunteered each fall since. He pastures dairy cows on his kudzu and peas from about October 1 each fall until late March or early April. Mr. Williams estimates that this combination has furnished pasture for at least two cows per acre over a period of 5½ months during each of the past five years. In discussing it, he said, "I figure that I get more grazing at less cost per acre from the kudzu-Caley pea combination than from any other grazing crop on my farm. And, this is from land that was practically waste land when the kudzu was planted." Montevallo shale is one of the poorer soils in the South, which makes the grazing Mr. Williams gets from these five acres all the more remarkable.

W. J. Bailey, Montevallo, Ala., has a 15-acre field of good cropland that he planted to kudzu in 1939. He began mowing the kudzu for hay in 1942. In raking kudzu hay, wild winter peas were dragged along by the rake and scattered from a small patch where they had been planted the year before kudzu was planted. Peas are now over the entire 15 acres and come up in thick stands in the fall. Mr. Bailey uses his

kudzu for hay or pasture, whichever he needs most. In 1948, he pastured 40 beef cows on the 15 acres from the first of August until frost on a basis of two weeks on kudzu and two weeks off. On February 15, 1949, he turned 40 cows in this field and left them until May 10. On July 24, he harvested a little more than a ton of kudzu hay per acre from the field and had enough new growth by the end of September for a considerable amount of fall grazing.

Mr. Bailey is a polled Hereford breeder and appreciates the value of good pasture. In commenting on his experience with this combination of grazing crops, he said, "I believe Caley peas and kudzu are the best combination of grazing crops that the hill land farmer can grow. These crops have produced the most feed at least cost per acre of any grazing crops we have. Cows relish Caley peas just as much as they do white clover. In fact, I have seen my cows walk out of white Dutch clover voluntarily and start grazing Caley peas."

Reseeding crimson clover and grandiflora vetch are volunteering in thick stands on kudzu at the Soil Conservation Service nursery at Thorsby, Ala. Grandiflora vetch appears to be particularly well adapted for some of the sandier soils where spring drought sometimes seriously limits the growth and seed production of wild winter peas.

An unfortunate misunderstanding about kudzu and sericea has been the idea that these are *poor-land* crops. It is true that both of these deep-rooted perennials have grown on some poor soils, sometimes with little fertilizer. In all too many cases, however, stands have been weakened by overgrazing or mowing and underfeeding. The result has been a few years of hay or pasture and then back to broomsedge.

All of the forage and grazing crops mentioned in this article must be fertilized properly if they are to grow, either alone or in combinations with other crops. All of the winter legumes mentioned here respond to liming, on soils that need lime. Where it is not convenient to get a laboratory test to find how much lime is needed, a ton or two of ground limestone per acre usually is a safe amount. A ton of finely ground limestone per acre on sandy soils and two tons on the heavier-textured soils may be applied early in the spring before reseeding crimson clover or wild winter peas is to be seeded in the fall. If this liming is repeated about once every five years, the needs of the winter legumes usually will be met.

All of the legumes require phosphate and potash fertilizer. About 500 pounds per acre of 0-14-10 or 0-12-12 fertilizer each year will keep both the summer and the winter legumes in vigorous condition. On the sandier soils where crimson clover is grown, about 10 pounds of borax per acre usually are beneficial. Combinations of plants that give long-season pasture on eroded uplands will pay good returns for regular applications of fertilizer.

One of the more interesting observations of these combinations of plants has been the effect the build-up of soil fertility has on the growth of the annual legumes. As an example, crimson clover and Italian ryegrass were seeded on a field in the Land Utilization Project of the Soil Conservation Service at Ackerman, Miss., in the fall of 1948.

All of the land in this project was purchased because it was considered too poor to be farmed economically. On a portion of this particular field where kudzu was planted several years ago, ryegrass and crimson clover made excellent growth in the spring of 1949. On a portion of the field where there was no kudzu, clover and ryegrass did not make enough growth to cover the ground. Fertilizer treatment was alike over the entire field. This serves to illustrate the importance of planting the perennial legumes first and following with the annual legumes and

the grasses after the land has been manured and improved by the perennial.

The wide variety of warm-season and cool-season plants that we have in the South gives us combinations to fit many different soil conditions. These conditions range all the way from the heavy clays of the Black Belt to sandy loams and even deep, loamy sands of the Coastal Plains. By making use of adapted combinations, we can put a great many acres of idle land to productive use.

Birdsfoot Trefoil . . .

(*From page* 11)

culty the field should be cut on the early side when most of the pods are commencing to change color and turn brown. The difficulty of obtaining the seed and their resultant high cost are the major obstacles in the increased use of trefoil.

Some seed growers are having most success by cutting with a windrow attachment on the mower and then combining after sufficient curing in the windrow.

It is frequently advisable to graze or cut the seed field up until the last of May. This reduces the bulk of material for threshing and tends to make the time of ripening more uniform. During dry years, however, there is frequently insufficient later growth to produce good seed. Whether the first crop is cut or grazed, it should never be done later than June 1 in Vermont.

Honeybees are important for good seed production because the plant is cross-pollinated The plant is practically self sterile and depends upon insects for pollination. It is an excellent honey plant, producing large quantities of high quality honey which commands a premium price.

Birdsfoot trefoil produces a large number of "hard" seed. These seed do not absorb water and many of them remain dormant for several years. This may be a "blessing in disguise" for it is nature's way of having some germinate and grow the second year if conditions are poor the first. This "hard" seed problem is another reason why better stands are not produced the first year and why rather heavy seeding rates are needed. Better methods of scarifying or scratching the seed coat, for uptake of water and better germination the first year, should be advisable provided all other conditions are right during the seeding year. In case of drought or winterkilling, however, the "hard" seed insurance has proved helpful on many fields.

Summary

Birdsfoot trefoil is a long-lived legume which is superior to alfalfa on the poorer drained clay soils. It is better than ladino clover on the drier lands, because of its deep root system. It withstands more abuse, particularly close grazing, than alfalfa or most clovers. It is less exacting in soil fertility or moisture requirements than other legumes, but under proper conditions it produces excellent hay, pasture, or silage. It grows on a wide range of soil conditions but does best on clays and clay loams. Up to the present time at least, it is subject to attack by fewer insects or diseases than most other legumes.

It also has some disadvantages. The plant is rather slow in getting started and frequently it is difficult to get good stands. Since it has rather thin weak stems it requires some grass to keep it upright. When properly inoculated it supplies its own nitrogen and some for associated grasses, but its nitrogen-gathering properties are less than those of

alfalfa or ladino clover. After first cutting for hay, it recovers slowly, but makes good aftermath or midsummer grazing. Production of seed is difficult and seed costs are high on a pound basis. However, its long life and the fact it does not need to be seeded frequently make the actual cost not excessive.

The following procedure should insure a good stand of birdsfoot trefoil if carefully followed:

1. Thoroughly prepare the soil and make a good firm seedbed.
2. Lime and mineralize the soil to a red clover level of fertility. Do not use manure the first year. Adequate lime and minerals in the subsoil are helpful for this deep-rooted plant.
3. Inoculate the seed with a special birdsfoot trefoil inoculin. Adding this first to a clay suspension or pulverized manure is advisable.
4. Plant only grass with trefoil. Brome grass or timothy is usually best. Do not seed clover or alfalfa with trefoil because they grow too fast and offer too much competition. If oats is used, it must be grazed or cut early when not over 8 to 10 inches high.
5. Plant on a firm seedbed and cover lightly with not more than ¼ to ½ inch of soil. The seed are small and have insufficient food to come through much soil.
6. Drilling a small amount of superphosphate directly with the seed frequently stimulates them to a good start, but cover lightly.
7. Prevent excessive competition by weeds and grasses the first year by frequent mowing or occasional grazing and mowing.
8. After establishment, allowing the plant to reseed occasionally is advisable.
9. Birdsfoot trefoil does best in long rotations. Since it starts slowly do not be discouraged the first year. It thickens up each year.
10. If you have some clay soil where alfalfa does poorly, it should be the first choice for a trefoil trial.

Buoyant Belgium

(*From page* 5)

they use plenty of mixed plant food under direction of specialists and experienced growers. Bunches weighing several pounds are not uncommon, and the home demand is keen, to say nothing of the excellent trade maintained in distant Paris, Geneva, and London.

In the specialized vegetable section we saw our old friend of a former rural ramble near Louvain—witloof chicory. This is the best fresh winter delicacy in its field. Growing chicory began away back in 1845 on the outskirts of Brussels. Just before World War II witloof chicory flourished on about 18,000 acres. It's a small farming industry. French cuisine delights in serving the brittle, white salad and has become Belgium's chief customer for chicory—taking 42,000 tons of the vegetable just prior to the recent hostilities. All adjacent countries use it freely and some even gets shipped over here by air and vessel.

Witloof chicory is a winter vegetation, grown in frost and snow. The roots are taken up in the late fall months and laid down in heated earth-mounded, metal-covered silos. The white sprouts burst forth out of the buried crowns and when all is ready for harvesting, all members of the family cut, clean, and sort the sleek, smooth white delicacy. Looking like snow-white ears of sweet corn, the product is layered into crates and packing boxes for the waiting connoisseurs.

Should any reader unfamiliar with

the quality of these two Belgian specials wish to learn more about the methods of culture involved, the best place to write is to National Des Debouches Agricoles et Horticulture, at No. 4, Quai de Willebroeck, Brussels. One of the members of the honorary committee at our Ellezelles exposition was a representative of this institution —Directeur C. Vandendaele. And by all means, don't forget to ask them all about those rare Belgian pears—which we lack either space or suitable voluble vocabulary to extoll as they deserve. Their aromatic taste will remain with us far longer than many another memory gained abroad. And if you have a little wall or other nook that needs beauty and utility combined, get their advice on training espaliers—those dwarfed, twisted, wire-supported tree fruits turned into vines. To our eyes they are strange, but to Belgians they are an old, established form of fruit culture. You can see a few of them at Mount Vernon, a relic of Washington's era when such quaint conceits were all the rage.

Belgian farmers are transformers of imported raw materials into finished food products—many of them delicacies. Before the last outrage, Belgium was almost self-supporting with most of the livestock products, raising roots, forage, and coarse fodder for animals. but not growing at any time enough coarse grains and millfeeds to go around. The farmers are trying hard now to get back where they left off in animal husbandry, yet not enough cereals will ever be grown in Belgium to feed out the livestock properly.

ABOUT 325,000 Belgium farmers work full time on their small holdings of a few acres. There are not more than 2,500 farms in the country which can point to as much as 125 acres under cultivation.

There is a distinct social class which is half industrial and half agricultural, these people working a couple of acres apiece. For the country as a whole, tenants occupy about half of the acreage in farms. Some of the owners are residents of the zone, and others live in the large cities. For every 100 acres of farm land in the country there are 13 persons engaged in agriculture—and as noted before, consumers of all kinds have a ratio of 200 persons to each 100 acres. So you have a rural-urban ratio of 13 to 187 for every 100 acres devoted to land tillage. No wonder their farm pattern is geared to high concentrated returns per acre instead of otherwise. But wise planners can see a real need to multiply the production power of this actual farm minority so as to more nearly meet the needs of the non-farm consuming majority. That's why the machinery section at Ellezelles was always such a busy, intriguing place. That's why European implement designers are studying ways to make their models more useful for all-purpose farm work, in imitation of the tractors which have made this country of ours the leading food source in the world.

YET make no mistake about it, Belgium is also a livestock paradise. We all know of its stout, proud, brown and dappled draft horses with the long names and manes, which we have seen plowing long furrows or stepping out to get a judge's ribbon at the state fairs—the breed that bears the nation's hall-mark. Our folks went to one of those fine old Belgian horse stud farms near Lembeek, and saw its gabled roofs, decorative brick homes, wide cobbled court and exercise yards, stone walls, and poplar trees. But the best horses were gone, and what were left were doing humble tasks, because of the ruinous war and the swift decline of horseflesh to do Britain's and America's farming.

We trod the same breeding ground and talked to the same draft horse leaders who not so long ago dealt in big figures with the ambitious farm horsemen of Iowa and Illinois—just a memory of a vanished power economy.

Even if this big slice of livestock exports and dollar-earning capacity is gone forever, Belgium still has about three-fourths of its farm land in crops for animal sustenance. To raise these plants vigorously on a limited available area next to crowded cities, the farmers there use as much, maybe more, organic matter and artificial fertilizers to each unit of surface as any other farmers in Europe. The Ministry of Agriculture served plenty of fertility figures at the big exposition in the little town. Per acre of all farm land in Belgium in the crop year of 1948, the country used 42.8 pounds of nitrogen, 46.7 pounds of phosphates, and almost 66 pounds of potash. The total over-all ratio of commercial plant food utilized, according to the accredited report, stands at 1 for nitrogen, 1.05 for phosphates and 1.49 for potash. This translates in tonnages to 79,500 metric tons of nitrogen, 86,600 metric tons of phosphates, and 121,100 metric tons of potassium, which was the estimated usage in 1948. Compared with our rates per unit of land it is large, but on the entire tonnage basis it is lower.

NATURALLY, with such a generous dosage of plant nutrients, the harvests respond nobly in Belgium—often ranking among the best in any modern agricultural country. These yields made eyebrows lift among the visitors last fall, but we are not skeptical in the least. For instance, winter wheat in 1948 averaged 37 bushels, rye went to 33 bushels, winter barley made 46 bushels, oats in a bad season hit 56 bushels, dried beans averaged 22 bushels, flaxseed reached about 8 bushels, mid-season potatoes yielded 398 bushels, and alfalfa hay reached over two tons an acre.

Well-fed on fertilized meadows and hay and beets, dairy cows averaged about 8,000 pounds of 3.2 per cent butterfat milk a year. The reported annual average egg production was 130 eggs per hen.

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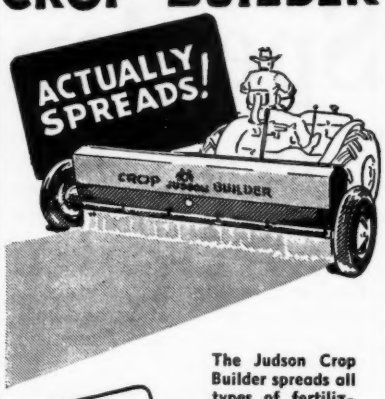

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Chief agricultural exports by Belgian farmers tend toward the semi-luxury goods in general. In the top listings in the 1948 exports from farms we noted 32,000 tons of apples, 15,000 tons of that chicory-endive delicacy, 3,200 tons of pears, 5,500 tons of cut flowers and nearly 2,000 tons of hothouse grapes.

Belgium has not quite five million acres of its land in farms. That seems very small and inconsequential in contrast to the 350 million acres or more that U. S. farmers put into all crop uses last year. Yet to them it is just as serious a matter to get the most from the least and to make the best better in all forms of farm endeavor. Maybe with all our huge empire of soil to perform upon we do not appreciate some of the little things that enter into a true balance in conservation and lasting land values. It is for this reason that I believe many of our exchange youth who are going over this season to live and learn on European farms will be able to bring back just as much fundamental knowledge as they will take over there.

FOR they will get a lot more benefit than appears on the surface of sight and sound, field lesson, and livestock precept and practice. They may not understand all that's told them like they do in the corner trading post here at home, but he who has eyes, let him see, and he with an open mind will quickly learn. This Belgium is an old and ancient domain, its customs and its methods and traditions of life and work are fixed and hard to change—and sometimes we wonder if it would be a net gain in all ways if we *did* change them.

For no man with breadth of vision and some history stored away in his mind can travel any of these storied lands abroad and see only as moderns see. Patient farmers and craftsmen in Belgium stem back for six centuries to the cathedral-building times and

the era when artisians formed self-directing and self-correcting leagues and unions—all pledged to complete as near a perfect task as man's feeble abilities would permit.

Talented sculptors and architects spent as much skill and put as much soul and toil into creating some image or decoration up on some high spire or pillar beyond the normal view of passersby as they devoted to an illumination on a prayer book page. They did not sign their names or take personal glory as their due. They were dedicated to skillful achievement, whether for religion, or art, or trade.

HENCE no youth—or elder too—who visits these so-called "backward" agricultural lands should fail to dig deeper than the surface of the soil to get his perspective. Moreover, he should not limit his "researches" to things in farm or feed lot, but he should travel around a little to trace some of these craft associates of olden times for whom the peasants of the Middle Ages provided food. The marvelous shrines, paintings, and halls of Belgium and adjacent lands have existed alongside the little divided farms for centuries, and you cannot clearly grasp the true meaning of one without studying and appreciating the other.

Call it cultural and educational, if you choose. Yet it's all that and much more—and it's something stirring within us that really makes all the work of man come finally to a common center to reach a common end. This is the doctrine of our own 4-H clubs and the bulwark of our best rural life. I think you sense this relationship of all crafts and our universal need of "recovery" or a new renaissance when you see old Europe struggling to restore itself. Maybe in aiding her a little in the right way we won't need to count it entirely as a one-way benefit. If Europe can't teach us much in farming, perhaps they can help us renew the stock of virtues we started out with.

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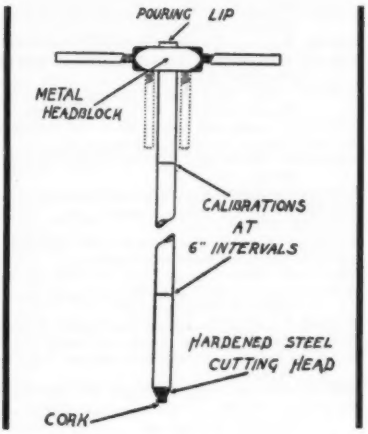

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Department of Visual Education, University of California Extension, 405 Hilgard Ave., Los Angeles 24, California.
Department of Visual Instruction, Oregon State College, Corvallis, Oregon.
Bureau of Visual Teaching, State College of Washington, Pullman, Washington.
Canada: National Film Board, Guelph, Ontario, Canada.

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of loan.

Request bookings from your nearest distributor.

A woman got on a bus and took the only empty seat, next to a harmless-looking reveller. Soon she opened a map of Manchuria and began to study it.

The reveller gazed at the map for a while and finally addressed the woman in an interested tone: "Sure you're on the right bus?" he asked.

* * *

"Sometimes, when I think of what you've meant to me all the years we've been married," the taciturn old Vermonter said to his spouse, "danged if it ain't more'n I can stand not to tell ye!"

* * *

Mose: "Ah called to see how my fren' Joe Brown was gettin' along."

Nurse: "Why he's getting along fine; he's convalescing now."

Mose: "That's O.K. I'll just sit down and wait till he's through."

* * *

"Pappy, ain't you gonna shoot that city slicker who didn't do right by me yistiddy?"

"Sure, datter—but don't be so tarnation hurrified; fust give me a chanct to shoot the one who didn't do right by you day before yistiddy."

* * *

Eunice: "Would you refuse to go out with a man who had made just one mistake?"

Clara: "Sure, who wants a man with as little experience as that."

"What a change has come over your husband, Zeke, since we persuaded him to join the church," exulted a preacher in the hill-billy country. "Have you noticed it?"

"Sure have," agreed Zeke's wife. "Before, when he went visitin' on Sundays he carried his jug o' corn whiskey on his shoulders. Now he hides it under his coat."

* * *

"Now, Mrs. Spreadbottom," said the doctor, "you'll have to go on a diet. All you can eat is some lettuce, carrots, green onions and green stuff."

"I don't understand," said the woman. "Do I take this before or after meals?"

* * *

"Gawdge," another equally unbleached gentleman inquired, "who is dat pouter pigeon gal yonder whut carries herse'f so pertuberant?"

"Why, dat's Miss Iodine Johnsing, fum Memfuss."

"Doggone! She sho' do put on a wonderful front, don't she?"

"Hush yo' mouf, nigger," was the reply. "Dat ain't put on."

* * *

Two men were discussing a mutual acquaintance.

"Nice fellow," said one, "but have you noticed how he always lets his friends pick up the dinner bill?"

"Yes," replied the other. "He has a terrible impediment in his reach."

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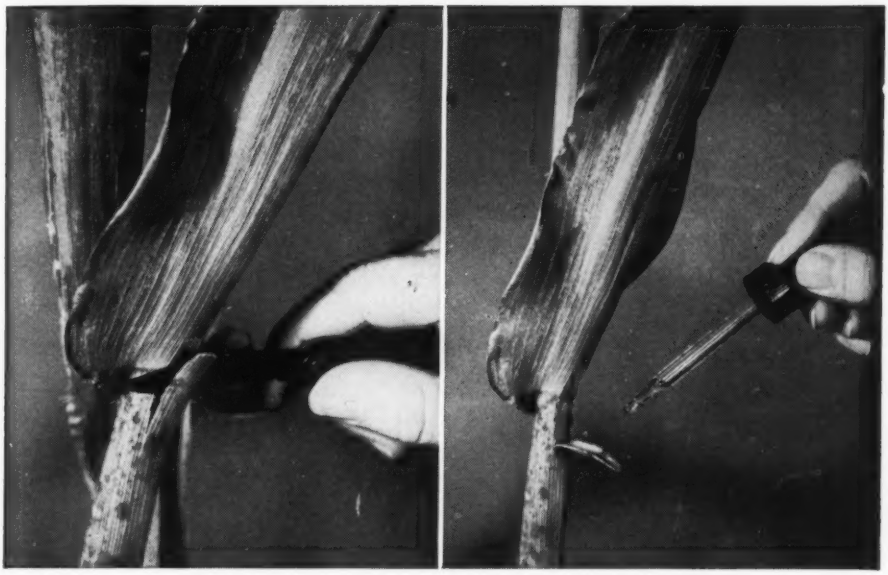

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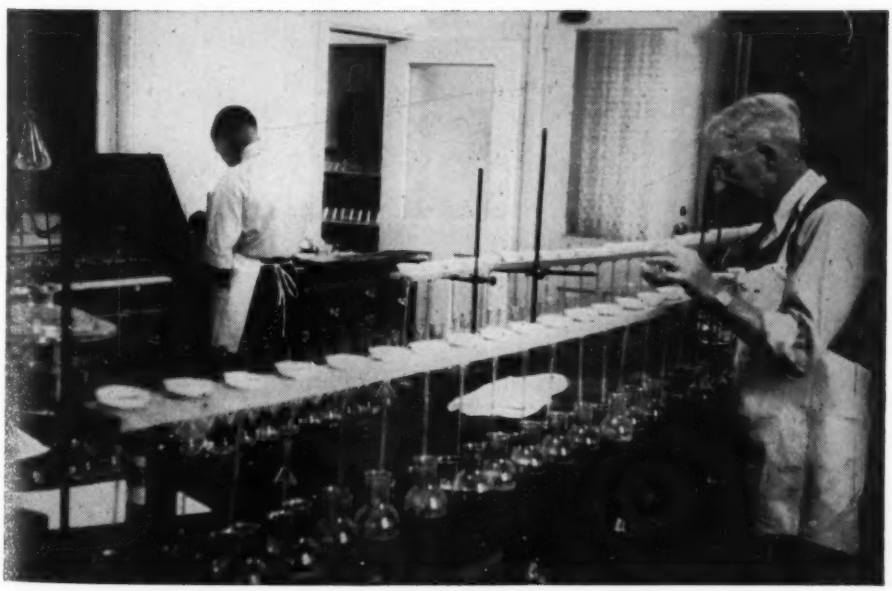

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